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CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

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The control of the Wabash is still uncertain, and present indications are that Mr. Ramsay has a reasonable chance for success, but belief in this is not strengthened upon reading his statement issued this week to the security holders. Presumably such a statement was made for the purpose of influencing their votes at the annual meeting on October 10. Nevertheless, for this purpose it is not understandable, even as a reply to unwarranted charges of ingratitude. It is largely devoted to a history of his personal relations with Mr. Gould, but in this history the security holders have slight interest. It contains, also, a record of syndicate operations, in the course of which either he or Mr. Gould, or both of them, have made or lost money. The publicity given during the past few months to syndicate operations has not been of a sort to inspire an investor with confidence. It would seem, therefore, to be at least undiplomatic to have brought this subject up for discussion before an audience of investors in the stock and debentures of the Wabash, although apparently justly provoked by personal attacks upon himself. It has not often occurred that the control of a great corporation has been wrested from another, or successfully held in a contest, by means of personal attacks through the newspapers. It has usually been done more quietly and by means well known. On the other hand, it has often occurred, as a result of an attempt at getting or defending control, and likewise as a result of negotiations for a championship prize fight, that the one who foresees failure makes open personal verbal attacks, sometimes containing a good deal of truth, to the end of leaving himself in a better position after a foreseen loss. Mr. Ramsey's suggestion, quoted in another column, of the possible loss or gain in traffic by the Wabash as a result of becoming independent, will be read with considerable interest.

"The Law is Good, if a Man Use It Lawfully," was the title of an article published in these columns last week. It has been republished in full and in part by many of the daily papers. It has been the subject of many daily paper editorial articles, of interviews with the President's private secretary, and of despatches from Washington correspondents. Apparently all of this attention has been given simply because the article mentioned a true incident of a sort familiar to every railroad president and general manager in the United States. The evil cannot be corrected by the carrying out of the proposal seriously made by many newspaper editors that Congress make an appropriation for paying the cost of presidential trips. It is common among public officers all along down the line, from the President of the United States to the justice of the peace or the coroner, to compel railroad companies to violate the provision of the Interstate Commerce Act against discrimination. The United States laws prohibit pooling, prohibit joint traffic agreements and prohibit discrimination. It enforces the laws against pooling and agreements; it does not enforce the law against rebates, and its officers and state and municipal officers violate this law and set the example. The public should know that the railroads are interested in precisely the same way, and proportionately to the same extent as they are, in needing the protection of the existing law against rebates. They should know these facts and the unwisdom of taking away from the railroad officers the power of making rates and entrusting it to a commission which has even less power than the railroads to protect themselves against the demands of the packer and other monopolists and public officers. It will be indeed a pity if the lesson derived from the presidential rebate should simply be a correction of one item of evil. This is small, indeed, by comparison, and was taken simply as a shining example. Some of the newspaper defences are amusing. One quotes an experienced passenger agent as saying that the "railroads lose nothing, as it stimulates business along the line" when the President travels.. This is undoubtedly true, but it does not justify violation of law. When the King of Great Britain travels he pays full first-class fare for himself and his companions in precisely the same way that any other first-class passenger pays. He does not pay the additional expenses incurred by the railroad company in transporting an exalted person. The railroad company provides a train of special cars, spikes all the facing-point switches, runs a pilot engine in front, and incurs a considerable expense which the first-class fares do not cover. This, however, is not the King's fault and he ought not to be asked to pay. Great crowds assemble at every station and there is the ever present danger from the lunatic. The railroad company, being a common carrier, must take these extraordinary

precautions. It gladly does so, because the addition to its local passenger receipts is enormous. For example, during the recent visit of the King to Edinburgh to review the Scottish troops the North British Railway sent out sixty special trains, loaded, in two hours and a half. The Caledonian, and other railways, also profited largely. The main point which the public should understand is that it is quite as much for the interest of the railroad company to treat all alike as it is for the public interest. Independent traders and manufacturers should not be smothered by monopolies, and government officers should not set the pace and pave the way to such iniquitous proceedings. It is the railroad's interest to build up business along its line and foster every paying industry. In this it needs no government control; it simply needs protection.

FEDERAL REGULATION OF RAILROAD RATES.*

It will be essential in any successful scheme for settling our interstate railroad rate problem to allow railroads freely to confer with each other; and (possibly subject to the veto of some Governmental authority) to freely contract with each other; and it will be highly important to improve the Interstate Commerce Commission—or whatever body performs the present functions of the Commission—by strengthening its personnel and by putting into it men having a thorough knowledge of railroad affairs. These two points deserve the careful attention of all thoughtful lawmakers. It does not seem possible that Congress will ever make it lawful for the Commission's rates to go into effect, on order, and remain in force until abrogated by the courts; and it is also quite plain that the proposition to have an Interstate Commerce Court, or several courts, as recently re-emphasized by Senator Elkins, cannot be made to fit all of the thousand details of the trouble that we desire to cure. The only value of a new court is a betterment of the methods of our existing courts—not any radical change from their methods.

That railroad rate-making officers ought to confer freely, and (in some situations) regularly, is almost self-evident to anybody acquainted with a general freight agent's work. The Sherman anti-trust law forbids combinations between competitors; and regular or formal conferences have in some cases been assumed to be a criminal step toward such combination. Relying on the unreasonableness of this construction, and on the disinclination of district attorneys to do absurd things, the traffic officers go on with their conferences. To be sure, there are not nearly so many of them as in former years, before competing roads had the benefit of community of interest and of the other conditions that now deter them from throat-cutting; but still the technically unlawful work goes on. And the Supreme Court has said that the Sherman law is rightfully applied with technical precision and minuteness, regardless of its absurdity. Conference between competitors, looking to the removal or prevention of those things which irritate soliciting agents and cause rate cutting and rate shading, would be necessary under ideal legislative regulation.

Moreover there is good ground for the hope that rate regulation by conference might now be highly useful in this country. The Joint Traffic Association, killed in 1898 by the Supreme Court's application of the Sherman law, had given promise of usefulness. It aimed to regulate competition without pooling, and in its short life had made real progress in that direction. Its constitution contained a vital provision in the regulation of rates on competing railroads—a rule to require the regular attendance of all competitors at all conferences. Usually the rate-cutter's first downward step in the path of sin consists in staying away from a meeting—avoiding the presence of his competitor. Such an association to-day could probably do more than any other instrumentality to rid the railroads of the domination of the beef trust.

With the railroads associated together now as they were in the Joint Traffic Association—lawfully and above-board—they could really co-operate with a Government commission in efforts to cure discriminations.

But to "*co*-operate" implies equality; hence we have said that the quality of the Interstate Commerce Commission should be improved; and Mr. Fink's suggestion of a way to do this seems good. There can be no question that two or three strong and high-minded men of railroad experience could improve the work of the Commission. If they were of judicial mind they could do great good, even if they had no higher function than writing dissenting opinions. The Commission has been reversed by the Supreme Court because it misinterpreted the law and because it deemed it safe to meddle with rates that could not be disturbed without causing other disturbances which could not be controlled. With better lawyers in its board it would avoid misinterpretation; but to avoid unwisdom, it will be necessary to secure the benefits of railroad experience. Railroad officers therefore may justly applaud Mr. Fink's suggestion and enthusiastically work for its adoption. To have a part of the Commissioners appointed for life would be only a reasonable step toward giving the Commission the dignity and stability that such a body needs. If we are right in assuming that the courts will never prescribe transportation rates—holding such an act to be non-judicial—then it is safe to say that in passing on the rate-making work of a Commission the courts will always presume the Commission's knowledge to be complete and its judgment sound—as the courts have done in the past, except where the evidence forced the abandonment of the presumption. This being so, it will be vitally necessary, in any rate legislation in the coming Congress to provide in the best possible way for a dignified and intelligent commission. Without these qualities, embodied in strong men of high character and free from political bias, there can be no hope of wise treatment of the interstate rate problem.

To the first of these two essentials (free conference and a wise commission), Mr. Fink adds a note intimating that the railroads, freed from the Sherman law and allowed to form associations, can probably deal effectively with private car lines. But these lines are essentially instruments of transportation, and they should be made subject to law to the same extent as the railroads. In some respects private cars are already subject to Federal law—as, for example, the safety-appliance requirements. A man dropping chunks of ice into a refrigerator car, or a porter making up a berth in a sleeping car, is clearly engaged in a department of transportation and the law should no longer split hairs about it. Mr. Fink says also that the repeal of Section 5, the anti-pooling law, is not necessary. He is a clear thinker and few men in America have a richer store of experience to guide them in forming opinions; but, if not repealed, this section ought to be made clearer. It well may be that the fight which would be developed by any attempt to secure repeal of the Fifth Section would be more costly than any possible benefit to be derived from the repeal. Pools are seldom perfect. It must be that they are born of woman, for they usually have a short life and are full of trouble. There will be no inconsolable regret if traffic pools are never again allowed; still, the anti-pooling section of the law condemns, in spirit, the traffic agreements which Mr. Fink desires to see again legalized.

Mr. Fink's suggestions for legislation are embraced under six heads. These are reprinted in another column. The only one of them on which there can be any reasonable disagreement, in principle, is the recommendation that the Cullom report of 1886 be reissued. Even in this the root idea is sound; the people ought to be educated. The Cullom report is one of our most valuable historical documents. But, like the Elkins report of the present year, it needs to be digested and greatly reduced in bulk, if its facts are to be made available to the thousands of laymen who need them.

On the separation of the work of supervising the safety appliance laws Mr. Fink is right in principle; but there would be strong opposition to the creation of a new bureau, especially at this time when so many Washington offices are under criticism. Everybody can see, however, that the present Commissioners take little interest in couplers and brakes and such things. The work in this department is wholly foreign to the habit of mind which rules in the other department of the Commission's work.

The one important element of the Government's problem which Mr. Fink ignores is that concerning the delays of the law. With the difficulties confronting us in every attempt to devise new methods of rate regulation—the constitutional and fundamental limitations on the powers of courts and of Congress, and the vast extent of our country—many even of the "friends of the people" would be glad to leave the laws as they are, if only the litigations which arise could be promptly settled. If controversies like the Chattanooga rate case, the Social Circle case and others on which the powers and qualifications of the Commission have been debated, could be appealed, retried and thrashed out within a few weeks

**Regulation of Railway Rates on Interstate Freight Traffic.* By Henry Fink, New York. 1905. Mr. Fink is the veteran Chairman of the Board of Directors of the Norfolk & Western Railroad. This book, a volume of 236 pages, embodies a review not originally intended for publication, but put in print on the advice of the author's friends. It is divided into three parts. Part I., "Regulation by the Railroads," describes how freight rates are made and gives full notes concerning the different traffic associations which flourished in this country in the last quarter of the nineteenth century. The subject is brought down to date and the Northern Securities decision is noticed. Part II. deals with Federal Legislation and its effects. Part III. deals with the agitation which has been going on for the past two years. The arguments against government rate-making are marshalled effectively. Mr. Fink's recommendations for legislation are printed in another column.

or months, instead of years, a reasonable crystallization of public opinion might be looked for. An "interstate commerce court" would be a court of specialists, presumably wiser and surely quicker in making decisions, but is without precedent of any importance; and in no department of government is experiment so undesirable, and lack of precedent so fatal as it is in the administration of justice.

Encouragement of Non-State Railroads in Russia.

The Russian Government began to build and acquire railroads for itself about 20 years ago. Previously nearly all railroads in the Empire had been built and were worked by corporations, though the government in nearly all cases guaranteed interest and dividends on the capital invested and was paying yearly very large amounts on this account. To-day the government owns about two-thirds of all the Russian railroads, and has of late years added largely to the state mileage; and it seemed its settled policy to make the Russian system substantially a state system. But last July the government made an announcement which seems like a reversal of this policy: "For the sake of attracting private capital for railroad construction in Russia, it is considered possible to grant certain aids and privileges." These are then enumerated as follows: State guarantee for the payment of interest and principal of bonds. The payment of dividends, not exceeding 3 per cent., on capital stock during the period of construction. The limitation of the state's participation in the net earnings of the new roads according to contracts to be made in each case according to circumstances. Putting farther in the future the time at which the state may purchase the road for its own account, making it 25 years from the date of opening. The reimbursement of the companies of any reductions in freight rates made by the government below the regular rates, in the course of the first five years. Reimbursement of the cost of construction required by the authorities and not necessary for the freight traffic. Payment for services rendered to the government, such as carrying mails. Immunity from charges for government police, inspection, etc., of the railroad.

The supposition is that in its then situation, with a great war pending which had already seriously reduced its resources, the government felt unable to construct the lines believed to be indispensably necessary for the development of the country. The great investments in railroads made by the state do not yet make any direct return. On the contrary the interest on the cost of the state railroads and the guarantees on private railroads exhaust the net earnings. This is not so surprising when we remember that not only the Siberian Railroad but some other long lines as yet do not earn their working expenses.

Whether the new policy will attract capital does not seem quite certain. In most cases the returns on the investment are likely to depend, for some time at least, on the government very much as if the state built the roads on its own account, and the companies have scarcely any discretion as to the rates they may charge. It seems certain, however, that the rational construction and management of many thousands of miles of new railroad in European Russia would be of an enormous advantage to the country and could readily be made to yield abundant returns on the investment. But though the country is in many respects similar to this, the population is so very different from ours that an American is liable to make great errors in forecasting the result of any such enterprise.

This announcement, be it remembered, was made last July. The close of the war since has certainly modified the necessities and may have changed the purposes of the Russian government.

Boston & Maine.

The Boston & Maine is the railroad ruler of northern New England. With the exception of 160 of its 2,286 miles of line, all of its mileage lies within the states of Massachusetts, Maine, New Hampshire and Vermont. Its ownership also is highly concentrated in New England, 7,052 out of its 7,631 owners, who represent 202,723 of its 266,592 shares, residing in the three states of Massachusetts, New Hampshire and Maine. North of the Boston & Albany, the Boston & Maine covers New England almost as completely as the New York, New Haven & Hartford does south of that constituted dividing line. Like the New Haven, its territory is the originating point of large amounts of manufactured products.

The Boston & Maine took a step similar to President Mellen's bold acquisition of a trunk line connection by the purchase of the Central New England and the New York, Ontario & Western, when, in 1900, it leased the Fitchburg. This lease was the direct result of the New York Central's acquisition of the Boston & Albany. The Fitchburg added 458 miles to the Boston & Maine's operated mileage and gave it a direct western connection from Boston and a voice in through traffic. As the New York Central controlled the West Shore, its lease of the Boston & Albany would have resulted, if the Fitchburg can be imagined to have remained an independent road, in its turning over all eastbound New England freight to the Boston & Albany, thus depriving the Boston & Maine of all its direct westbound business. With the Fitchburg in its possession, the Boston & Maine could demand and secure its share of eastbound traffic, for it has western connections other than through the Albany gateway. By shipping north over any one of its three lines to Portland, where it connects with the Grand Trunk, or northwest to its connection near the Vermont-Quebec boundary with the Canadian Pacific, the Boston & Maine can always reach the west. By throwing all of the large westbound traffic originating in the territory north and northwest of Boston to these northern Canadian routes, the New York Central would have been deprived of a large amount of westbound business. Thus the routing of freight by the New York Central over the present Fitchburg division of the Boston & Maine is on a reciprocal arrangement by which the West Shore gets westbound traffic from the Boston territory, and the Boston & Maine in return receives eastbound traffic from the West Shore at Rotterdam Junction.

The Boston & Maine, although serving almost as dense a territory as the New York, New Haven & Hartford, is handicapped by the greater severity of the northern New England winter, which requires, during two or three months of every year, large extra expenditures on account of snow and ice and adds greatly to the expense of moving traffic. This, combined with the highly conservative policy of the company in charging betterments directly to expenses, explains the high operating ratio of 73.5 per cent.

The present report is especially interesting, because the fiscal year ended June 30 completes a period of five years' operation since the lease of the Fitchburg. During this time there has been no material change in mileage, so that an accurate judgment may be formed of the growth of the railroad during the five-year period.

In 1901, the first fiscal year after the Fitchburg lease, gross income was $31,375,620, against $22,865,977 in 1900, the year before the lease. In the succeeding years, gross income has yearly increased to $32,430,595 in 1902, $34,266,608 in 1903, $35,471,492 in 1904, and $36,800,834 in the year just closed. This is a five years' growth of $5,425,214, or over 17 per cent. At the same time, the annual fixed charges have increased only $131,100 and the annual dividend payments only $161,646, a total increase of $292,746 in annual fixed charge and dividend requirements. Thus these charges for the year ended June 30, 1905, were less than 3 per cent. greater than for the year ended June 30, 1901, while gross income had increased 17 per cent. during the same length of time.

This very large and disproportionate growth of earnings over fixed charges and dividends has enabled large annual expenditures out of current income for permanent improvements to the property. During the five-year period, there was spent out of earnings: for repairs of locomotives, $1,349,315; of passenger, baggage, mail and express cars, $680,524; of freight cars, $963,716; repairs of roadbed and track, $2,224,478; for rails, ties, ballasting and maintenance of bridges, buildings and structures, $1,859,179. The amounts expended last year for these decisive items of maintenance increased $1,431,403, or 25⅓ per cent. over the same expenditures in 1901. That such large expenditures could be consistently made during this period at the same time that dividends aggregating $8,766,727 were paid on the company's stock is an example of the peculiar conservatism and prosperity of a New England railroad.

In the year just passed, there were paid for out of the year's current income, 38 locomotives, 130 freight cars and 31 passenger cars of various kinds, their cost, including expenditures on 576 new freight cars in process of construction, but not completed, amounting to $807,782. There was charged to capital account, $452,155, which was expended in the elimination of grade crossings. The total net expenditure to June 30, 1905, for this purpose has been $2,804,274.

With an increase of $1,318,637 in gross earnings, there was a decrease of $29,195 in net earnings, though this would not be guessed by a casual reader of the report, as no comparative figures for net earnings are given. Of the $36,213,246 gross earnings, 39.5 per cent. were passenger earnings and 60.2 per cent. freight earnings, the percentage of passenger earnings being about 10 per cent. smaller than on the New York, New Haven & Hartford, where the two classes are still approximately equal.

Operating expenses cost $25,811,959, plus $807,782 for new equipment, a total of $26,619,740. Maintenance of way took $4,501,378 of this; maintenance of equipment, $3,396,380; conducting transportation, $17,117,307, and general expenses, $796,894. Maintenance of way cost $1,967 per mile; maintenance of locomotives, $1,460 per locomotive. Conducting transportation increased $141,740 over 1904.

With its large local traffic and short through hauls, the Boston & Maine does not have a large train load. This was 212 tons in 1905. However, this is an increase over the figure for 1904, which was 203 tons. In 1903, the train load was 207 tons; in 1902, 201 tons, and in 1901, 202 tons. The profitableness of the freight business comes not from a high train load but from the high grade

of traffic and the high average rate received, which was 1.152 cents per ton mile against 1.178 cents in 1904. The list of commodities carried shows throughout a high proportion of high grade tonnage. In point of tonnage, the principal commodities were anthracite coal, 1,461,754 tons; bituminous coal, 3,044,927 tons (against 2,867,164 tons in 1904); grain, 1,068,871 tons; lumber, 2,418,089 tons; merchandise, 1,249,164 tons, and miscellaneous, 2,095,234 tons, the latter two classifications, high grade and profitable traffic.

The average gross earnings per mile of road were $16,082, against $15,521 in 1904; net earnings, $4,192, against $4,210 per mile of road in 1904. The average rate per passenger mile was 1.755 cents, a small decrease from 1904. The average distance each passenger traveled was 18.17 miles, and the average haul per ton of freight, 90.24 miles. Of the total number of passengers carried—41,874,810—22,880,000 traveled to and from Boston, a clear indication of the great density of the Boston & Maine's passenger traffic.

There is soon to be voted on by the stockholders the issuing of bonds to an amount not exceeding $10,000,000 for refunding purposes; also an increase of $4,203,700 in the common stock and the issuing of $5,331,900 common stock for the purpose of buying 6,000 additional freight cars at a cost of $5,000,000, building new shops to cost $1,000,000, 27 miles of second track to cost $1,100,000, and covering the Boston & Maine's proportion ($1,600,000) of amounts to be expended in grade crossing elimination. This covers the general financial plan of the company for a period of at least five years to come.

From the new issue of bonds, material reductions in fixed charges amounting, on and after Sept. 1, 1906, to not less than $343,000 annually, will result. On that same date, it is proposed to apportion the $5,331,900 common stock among the stockholders to the extent of three-eighths of their holdings. Of this $5,331,900 new stock, $1,128,200 is owned by the company and now held as collateral for payment of certificates of indebtedness of an absorbed line. When released by the payment of these notes, this amount will be combined with the new issue authorized ($4,203,700) for the distribution.

In justification of the proposed expenditure of $5,000,000 for additional freight cars, the increase in the company's freight business during the last five years is cited. In 1901, 17,516,517 tons were carried and $18,208,515 received in gross freight earnings. These figures have increased during each year in the period to, in the year just closed, 20,546,826 tons and $21,808,070 gross freight earnings. This makes a total increase in the five years of 3,030,255 tons carried, or 17 per cent., and of $3,599,555 gross earnings, or 19 per cent. During this time 3,024 new freight cars, a number clearly disproportionate to the increase in freight traffic, have been bought in replacement and as additions. Both for this reason, and particularly because the greater and most profitable part of the Boston & Maine's freight traffic is local and domestic and must be forwarded and delivered as quickly as possible, the 6,000 new cars are required. The new shops are to be built at Somerville, Mass., where 100 acres of land have already been purchased and improved. This site has a navigable water approach on the Mystic river and is on the Boston terminal division, thus having convenient access by water and from all of the company's lines. The second-track construction recommended is on busy sections of the Eastern and Western divisions, where the lack of second track now causes frequent and expensive delays, particularly in freight service. The amount apportioned to grade crossing elimination will, it is expected, be sufficient to provide for the Boston & Maine's proportion of the total cost of this work during the next six years.

Assuming that 7 per cent. dividends shall be paid upon the additional $5,331,900 of stock, the estimated annual charges on the issue will be $433,000; but, as there will be at the same time an actual saving of $343,000 in first charges through refunding operations, the total net increase of the combined annual dividend disbursements and fixed charge obligations will be not more than $90,000 greater than at present, a sum only slightly in excess of the surplus earnings of the past year. The added amount, however, will undoubtedly be supplied from the increased income which will result from the enlarged facilities furnished.

During the past year, the Boston & Maine has asked authority from the Massachusetts Legislature to acquire and control electric lines. As yet, although at various points in its highly populated territory there has been severe competition and large losses from electric competition, the company has not fallen in with the New Haven policy of acquiring such branches, with the exception of two electric lines which it built and owns as branches of its steam lines. One of these is 18 miles long, in the city of Portsmouth, and the other 28 miles long, connecting Concord and Manchester. With permission granted by the Legislature to make such investments, and particularly following the good showing recently made by the New Haven's electric lines in their first reported year of operation, it is not unlikely that the Boston & Maine will follow the Mellen policy and before many years be in control of its various electric competitors. This will be one of the most interesting developments to watch, especially in comparison with the New Haven's electric policy. With the passenger business furnishing 34 per cent. of the revenue, there surely is inducement for taking care of electric competition. The Boston & Maine serves such a highly developed territory and serves it so completely that it can hardly afford to have anything else than a complete monopoly of the transportation facilities.

The Maine Central, which the Boston & Maine controls by the ownership of more than 50 per cent. of its stock, earned during the year $7,251,536 gross, against $6,912,982 in 1904, and $2,375,334 net, against $1,811,438 in 1904. Of the gross earnings $2,809,854 were passenger earnings and $4,289,365 freight earnings. The net income after charges was $2,110,066, an increase of $219,988 over 1904. During a period of ten years, the company's gross earnings have increased by $2,240,917, or 44.72 per cent.; operating expenses, 49.04 per cent., and taxes, 166.31 per cent. Improvements to cost between $400,000 and $500,000 are projected, to provide for a part of which $300,000 has been set aside out of the current income for the year. Most important among these are new terminal facilities at Bangor, Me.

For the Boston & Maine, the principal statistics of operation follow:

	1905.	1904.
Mileage worked	2,288	2,288
Passenger earnings	$14,291,615	$13,971,273
Freight earnings	21,808,070	788,779
Gross earnings	36,213,246	34,894,608
Maint. way and structures	4,501,378	3,828,702
Maint. of equipment	3,396,380	3,295,832
Conducting transportation	17,117,307	16,975,565
New equipment	807,782	350,988
Total operating expenses	26,619,740	25,271,908
Gross income	36,800,834	35,471,492
Net income	1,883,572	1,849,456

NEW PUBLICATIONS.

Maple Leaf Bulletin, St. Paul, Minn.

This is the title of the first number of a magazine which the employees of the Chicago Great Western propose to issue, if they find sufficient support and encouragement. The first number contains 32 pages and is dated September. The price is 50 cents a year, but the frequency with which the magazine is to be published is not stated. The committee of publication consists of Messrs. J. H. Sayle, T. N. Flynn and J. F. Richards. The first number contains interesting reading on the use and abuse of the "19" order; on congested terminals, and on the handling of freight to reduce damage claims; the latter being in the shape of a report of a meeting of agents recently held. An extract from this report is given in another column. There are also a half dozen pages of miscellaneous matter. The front cover bears a fine portrait of the President of the road, Mr. A. B. Stickney.

TRADE CATALOGUES.

Electric Cars.—J. G. Brill Company, Philadelphia, Pa., has issued a large general catalogue of electric cars and trucks, which aside from being a handsome piece of book work is a valuable record of current practice in electric interurban and city railway car construction. More than 40 standard types of cars for almost every class of service are illustrated and described with tables of their principal dimensions. The cars shown are characteristic of the output of this company's large plant and represent the latest developments in this important field. More than 20 pages in the back of the book are devoted to descriptions of the various types of trucks which are made by the same company, including the well-known maximum traction and 27-E patterns. A number of car specialties, such as doors, brake handles, etc., are also shown. Copies are being distributed to railroad officers in this country and abroad, and will be sent on application. Cloth, 10 in. x 14 in. Ninety pages.

Graphite Paint.—The Detroit Graphite Manufacturing Company, Detroit, Mich., sends a neat little booklet, entitled "Rust, and How to Prevent It." A brief explanation of the causes producing rust is given and the method of protecting steel structure by the use of a properly prepared paint is explained. Illustration of the cantilever bridge at Niagara Falls and other well-known structures which are painted with Superior Graphite paint are also given.

Mechanical Stokers.—The Under-Feed Stoker Company of America, Chicago, sends a handsomely gotten up catalogue in which is given detailed illustrations and descriptions of the Jones under-feed stoker. The methods of installation and of operating the stoker, as well as of the economical results obtained by its use, are set forth, and numerous illustrations of plants equipped with the Jones stokers are also shown.

Tie Plates and Spikes.—Dilworth, Porter & Co., Pittsburg, Pa., send a handsomely illustrated catalogue descriptive of its "Glendon"

longitudinal flange tie plate and the "Goldie" claw tie plates, as well as of the "Goldie Perfect" steel railroad spike, and of boat and dock spikes. Aside from the illustrations and descriptions of the above the catalogue contains various tables of interest to track men, such as the number of tons of rails of various weight that are required per mile of track, the number of cross ties per mile of track when placed at different distances apart, and the number of splice joints per mile for different lengths of rails.

Locomotive and Car Journal Bearings.—The A. C. Stiles Anti-Friction Metal Co., Baltimore, Md., and New Haven, Conn., sends an illustrated catalogue descriptive of the "Stiles" patent car journal bearings and of the "Stiles" anti-friction locomotive driving journal bearings. A detailed description of these bearings will be found on another page of this issue.

Metallic Packing.—The United States Metallic Packing Co., Philadelphia, Pa., sends an interesting catalogue descriptive of its metallic piston rod and valve stem packings. Halftone illustrations showing elevation and sectional views of the Gollmar bell ringer made by this company are also given.

Generators and Air-Brake Equipments.—The National Electric Company, Milwaukee, sends two pamphlets, one describing its direct-current belt-driven generators, and the other describing and illustrating the "Christensen" air-brake equipment, of which more than 15,000 are in successful operation on high-speed electric cars.

Copper and Metal Gaskets.—Frederick Goetz, New York, sends an illustrated folder descriptive of the Goetz's elastic profiled copper and metal gaskets. These gaskets are made of copper and asbestos, and it is claimed that they are especially adapted for use in high temperature work.

Car and Track Jacks.—The Duff Mfg. Co., Pittsburg, Pa., sends a small pamphlet bearing the title "Frenzied Jack-Sense," which contains a number of comic verses inspired by Archimedes and the "Barret" jack.

CONTRIBUTIONS

E. B. Phillips.*

Tenafly, N. J., Sept. 29, 1905.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Please state that Mr. E. B. Phillips was elected President of the consolidated Lake Shore & Michigan Southern Railroads, not a Vice-President, as I said in a previous communication.

CHARLES PAINE.

Forms of Signals.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have read the editorial on "Forms of Signals" with a great deal of interest, and it certainly impresses me as a very timely article. From personal experience I have realized the growing difficulty of instinctively differentiating between the various characters of signal indications. A further cause for confusion, not mentioned in your editorial, is the difference in the form of blades between controlled manual and automatic block signals, the latter having pointed ends and the former square ends. I thoroughly agree with you that the first consideration for an ideal signal system is the simplicity that will enable the engineman to act instinctively rather than by a process of mental reasoning. Just how this shall be done is, as you say, open to a wide difference of opinion, but I think that your editorial is excellent for the purpose of drawing the attention of all railroad men to the necessity for discussion and a general adoption of a simplified form of signals.

VICE-PRESIDENT.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have read with considerable interest the editorial entitled, "Forms of Signals." It seems to me that the semaphore is the ideal form and it should be used for all indications. Certainly if we attempted the use of the semaphore, we will say, only for interlocking, a banner signal for switches, some form of disc signal for block signals and some other form of signal for train orders, we would make the matter worse rather than better. There are two forms of semaphore signals, the stop and the slow signal. If these signals are respected, no harm can come, but if we are going to change the form of signals and have one signal under which an engineer will understand he is not required to stop immediately, another where he is going to turn off at a junction, and another where it is simply a train order and he can run by the station if he wants, we are going to have a worse condition than now exists. There is nothing so simple as a semaphore, and my judgment is we better stick to it. If the men do not understand the signal or get confused, they can take the safe side and run slow, or stop, as the signal may require. A very large part of the train movement is at night and must necessarily be governed by lamp signals, of one form. The same thing is indicated in daylight by the semaphore. Why attempt to change a day signal which is used during the time of less danger, when the night signals cannot be successfully changed?

PRESIDENT.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have read with great interest your editorial article on "Forms of Signals." The subject is unquestionably one of great importance, and one which, unfortunately, has had altogether too little consideration. On many important railroads an effort has been and is being made to transmit to an engineman in charge of a rapidly moving train a great number of indications by means of semaphores of various forms displayed in different positions. In general the engineman who is thoroughly acquainted with the line, correctly interprets these various indications, but in many cases serious accidents have occurred through misinterpretation, and it seems to me that if a system of signaling can be devised that is so simple as to require no conscious mental effort on the part of the engineman for its correct and instant interpretation, the adoption of such system would lead to a material lessening of train accidents.

You have suggested as a line of study, the consideration of two types of signals for general use, one type to

"indicate the physical condition of the track considered as a structure, and to be used for switches, drawbridges, and interlockings" and the other type "to direct train movement, or to restrict it by reason of the occupancy of the track and to be used as block, starting and train order signals."

If it be conceded that two types of signals are necessary, it would still be open to question as to whether the grouping suggested by you for each of the two types might not be improved. Might it not, for example, be a much more natural and better classification to have one type indicate automatic and the other non-automatic operation? I incline very strongly toward the opinion that we should not try to indicate to the engineman by means of high-speed, fixed signals, so many things that he is altogether likely, sooner or later, to misread or misinterpret such indications, and for this reason I believe the number of indications given by such signals should be the smallest possible, having due regard not only to the safety, but also to the facility of train movement, and, further, I believe that signals of similar form by day, or of similar color by night, should give identical indications at all times and under all conditions to the engineman.

It is pretty generally admitted that the most satisfactory means for giving night indications is found in employing "color" signals; that no color should be used for high-speed signaling that is not readily distinguishable from colors ordinarily employed for illuminating purposes; that each color used for high-speed signaling purposes shall be readily distinguishable under all atmospheric conditions from all other colors employed for the same purposes; that a single color for a single indication is more readily readable and requires less mental effort for its correct interpretation than combinations of two or more colors. Assuming the above statements to be correct it is practically certain that at the present time we have but three usable colors for high signal night indications, viz., red, yellow and green. If this be true and if, for an average of 12 hours out of every 24 we are limited to three single color indications, it would seem to me entirely logical and consistent to limit to the same number the day indications, and it is my belief that the indications of high fixed signals may be limited to this number both by day and by night without undue delay to train movement, and with material reduction in the liability to having enginemen mistake such indications, since they may be given in such a simple and unvarying manner as to enable the engineman when running at the highest possible speed, to correctly identify each indication as soon as he receives it and without any conscious effort of memory. If, for example, the colors red, yellow and green be invariably employed to correspond respectively with the horizontal, the 45 degree, and the vertical positions of a three-position signal arm, not only the engineman but all trainmen would very quickly learn to associate the position with the color, and it is altogether likely that in describing any given day signal it would be spoken of always as a red, a yellow, or a green signal, rather than by reference to its position.

Personally, I do not doubt our ability to give to enginemen on trains moving at high speeds three unmistakable, clear, arrestive signal indications both by day and by night; but I do question the possibility of giving more than three, and I am not at all sure that it would be wise to attempt to employ more than three, even if we had them available.

If the number of such indications be limited to three, it seems to me these indications, corresponding respectively to the colors, red, yellow and green, should mean the following, viz.:

(1.) Stop.

*The obituary of Mr. Phillips was published in our issue of Sept. 22.

(2.) Proceed under full control, prepared to stop at the next fixed high signal.

(3.) Proceed at regulation speed.

Objection may be made to the employment of a signal of invariable form and position to indicate "stop" in view of the fact that at the present time "stop" signals of varying forms and positions are employed to impart to the engineman not only the information that he is to stop, but, at the same instant, to tell him "*why* he is to stop." I believe that as this special information is given only by the day signals, it is much better, for the sake of uniformity and simplicity, to eliminate it by day, making the day and night indications absolutely identical in meaning. It will meet all reasonable requirements if means be provided whereby the engineman secures such special information after or immediately before bringing his train to a stop, and this can be done in a variety of ways, one of which would be by fixing to the signal mast, under the signal, a large outline letter, as for example, "A" for automatic, "I" for interlocking, and "O" for order signals. The headlight illumination will suffice to enable the engineman to read such letter by night.

Other objections, too numerous to discuss in this brief criticism of your article, may be anticipated with respect to the above suggested plan; but I believe it to be practical and that any American railroad willing to assume the expense of installing a system of high, fixed signals, designed to give but three indications to the engineman, could secure better results than are had under present practice. Unquestionably, at certain points, as for example, at main line junction points, with diverging tracks out of each main track, and with possibly a joint station located at such junction, it might be found necessary, in order not to depart from the "three indication" plan to require certain trains to proceed more slowly than they would do under usual practice; but I believe that the loss of time due to this cause would be of little moment in comparison with the uniformly safer and simpler operation at all other points; and by carefully studying the traffic requirements at each such point, designing the track layout to suit, properly locating the high and dwarf signals, and by providing track circuits where required, very little, if any delay need be occasioned by the adoption of such a plan, even at the points of maximum complication.

All the foregoing has had particular reference to the *high*, fixed signals, and while it is not within the scope of this letter to detail every feature of the "three indication" scheme, as suggested for such high, fixed signals, it may be proper to suggest that low signals, such as dwarfs, may be used for diverging route signals at the foot of high signals governing over a main track having facing point switches, and that dwarfs so employed may be provided with a glass of other color than the three above named, for the "proceed" indication by night and when the signal is not set in the "proceed" position no color indication need be given, since the high signal provides all the "stop" indication that is required. This arrangement eliminates the necessity for trains running at high speed past a "red" signal. For "back up" movements the dwarf signal may give two color indications, the "proceed" indication being of the fourth color, as above indicated, and the "stop" indication being "red" as on the high signal. In this connection it may be well to note that whereas three colors only are readily distinguishable from each other by night, at considerable distances and under the ordinary variations of atmospheric conditions, other colors are clearly distinguishable from these three at the short distance at which it is necessary for an engineman to get his dwarf signal indications.

Under the plan proposed, an engineman would, by night, have none other than the following high signal indications, viz.:

One red light only.
One yellow light only.
One green light only.

With present practice the following are a few of the many color indications given by high signals on certain important railroads:

One red light only.
" " " above a white light.
" " " " a green light.
" " " " a red light.
" " " " two red lights.
" " " " one red and one white light.
" " " " " green and one red light.
" " " " " " and one white light.
" " " " " " one red and one green light.
" " " " " " one white and one green light.
" " " " " " and two white lights.
" " " " " " one red, one green and one red.
" " " " " " one red, one green and one white.
" " " " " " one white, one green and one red.
" " " " " " two white and one red.
" white light only.
" " " above one white light.
" " " " " red light.
" " " " " green light.
" " " " two red lights.
" " " " one green and one red light.
" " " " " one white and one red light.
" " " " " green, one red and one green light.
" " " " " white, one red and one green light.
" " " " " green, one red, one green and one red light.
" " " " " white, one red, one green and one red light.

There are numerous other color combinations regularly employed, but enough have been noted to show what some enginemen are required to observe and interpret in a single night's run, and when it is borne in mind that a single signal means not only one thing, but may mean several things, the situation is not at all improved. For example, a single white light displayed in connection with a fish-tailed blade means to the engineman that his line is clear up to the second succeeding home signal; but, displayed in connection with a square ended blade, it means that the line is clear up to the next succeeding home signal; or it may mean neither the one nor the other of the two things above noted, but may, on the contrary, be the lower light of a two-arm signal, the upper light of which has been extinguished, in which case the signal is almost certain to be falsely interpreted and to result in a dangerous condition, or it may be a falsely displayed clear signal due to the breaking of a glass in a signal spectacle, which might also cause serious trouble.

I thoroughly believe this whole matter should have the consideration of the best signaling and operating men on our railroads, and I feel sure that the *Railroad Gazette* can do much toward calling attention to the need for simplification of signaling in its relations to the engineman, and that whatever is done in this direction cannot fail to greatly benefit the railroads and their patrons.

W. W. SALMON,
President General Railway Signal Co.

To the Editor of the Railroad Gazette:

Your editorial on "Forms of Signals" is timely and should have the serious consideration of railroad managers before adopting schemes for individual lines. As signals multiply it will be apparent that some plan is necessary or at least desirable to simplify the rules, and minimize the requirements for a correct reading of signal indications in all cases. It will be easier to standardize such a plan now than at any future time. Managers will adopt a standard much more readily than they will change to one after local plans have been worked out and put in operation, especially if a change carries with it any considerable expenditure. The history of all standard codes will bear out this statement. The questions raised in your editorial are well worthy of the attention of the American Railway Association through its Committee on Safety Appliances. Seemingly it will not be difficult to arrange a standard practice satisfactory to all railroads if undertaken before varying practices are adopted by different managements.

In this connection it may be well to refer to one difference in practice that obtains on American railroads, that is, the arrangement of semaphore arms on masts carrying two or more signals. Some railroads contend, and enforce their contention by their practice, that the top arm should govern the route to the farthest right-hand side lower arms for routes from right to left in that order, usually having the arm governing the high-speed route of larger size than the arms for subordinate routes. This may be a sufficient distinction for day indications, but is not satisfactory to all for night indications even though a larger lens is used for the high-speed route. The order of right to left is quite satisfactory for yard signals or where no distinctively high-speed route is involved, and some maintain that there should be only one arrangement and rule for all signals. Other roads contend that the high-speed route is of paramount importance and that there should be but one place for the signal governing it, at the top of the mast, regardless of the fact as to whether it is to the right or left or intermediate, and that all subordinate routes should be governed by a lower arm, or if necessary for more than one such signal the arms should be placed in the order of right to left. This difference in practice is mentioned to illustrate the fact that other differences in practice will likely arise, especially along the line suggested in the editorial under consideration, and also to suggest that the questions now raised be broadened to include the location and arrangement of signals where more than one is used on the same support.

It is obvious that any new standards should conform as far as possible to the general existing practice providing there are no serious objections to it either as to its safety, practicability or comparative simplicity. Fortunately there is little to change to secure uniformity at the present time. The rules of the American Railway Association are simple and direct and cover as briefly as practicable the necessary regulations both as to the semaphore and disc signals and their indications. The colors and positions are as few as possible and easily remembered, but thus far no uniform provisions have been made for distinguishing between interlocking, manually controlled, automatic, train order, drawbridge, route and siding signals. The first two can be easily and safely combined without any change as they are both absolute, and operated under the "stop and wait" rule, i.e., these signals are not to be passed when in the danger position, the indications being given by the square end semaphore arm. The distant, or caution signals, are distinguished by the forked or fish tail end.

Automatic signals are operated under an entirely different rule

providing that after a stop has been made a train may proceed under the restrictions contained in the rules. It is quite clear that signals used for this purpose should be easily distinguished from those operated under the first mentioned rule, otherwise the knowledge of the enginemen as to the location of different signals as unnecessarily required and their memory unduly taxed, with the possibility of error and consequent delay or danger. Some roads have adopted a pointed semaphore arm for automatic signals. This change can be readily made and with inconsiderable expense. Should this become a recommended practice where semaphores are used by the action of the association no doubt uniformity in this particular would quickly follow. The disc signal is more distinctive and no change either in rule or practice is necessary or even desirable.

Train order and drawbridge signals are operated under the absolute rule, but it is at least desirable for the engineman to distinguish between them and block eignals without bringing any special knowledge or their memory into requisition. In the case of train order signals it is necessary to do more than stop. Orders must be obtained with the least delay. Perhaps all that is necessary in this connection is to paint the words "Train Orders" or "Drawbridge," as the case may be, plainly on the semaphore arm. This special knowledge is only required after the stop has been made and the enginemen are in plain view of the signal. The question of route signals in yards can be easily disposed of. They should be, and usually are, placed on the right of and immediately adjoining the track they govern, or in the case of overhead supports, immediately over the track they control.

An arrangement of outlying route signals adopted by at least one important road has many advantages and is well worthy of consideration as recommended practice by the association. The route signals are placed on the high-speed semaphore mast at least 10 ft. below the high-speed signal. Such an arrangement would meet the main objections to both practices already referred to and settle a much debated problem.

It is probable that there would be no serious objections raised by any one to a further rule that all route signals should be placed in the order of right to left. The top arm governing the route to the farthest right, the second arm the next route to the left; other arms, if any, in the same order to the left.

Interlocked switch or siding signals are sufficiently covered by what has been said in regard to route signals. Siding signals not interlocked or switch targets are foreign to the present discussion, uniformity is desirable but not practicable or necessary at the present time. This question will settle itself when lines are completely signaled.

Referring more directly to the principal suggestion in the editorial above mentioned, a possible simplification by using one form of signals to indicate the condition of the track and another form to indicate the occupation of the track, such an arrangement would seem to complicate rather than simplify. In the first place these two facts, whether the track is safe or occupied, are not sufficient to enable an engineman to act intelligently in all cases. Take the single question as to the occupation of the track. Some lines and parts of lines are signaled on the absolute principle, others on the permissive, some by manually controlled and others by automatic signals each requiring a distinct indication to secure the desired results and all different from signals indicating the condition of the track.

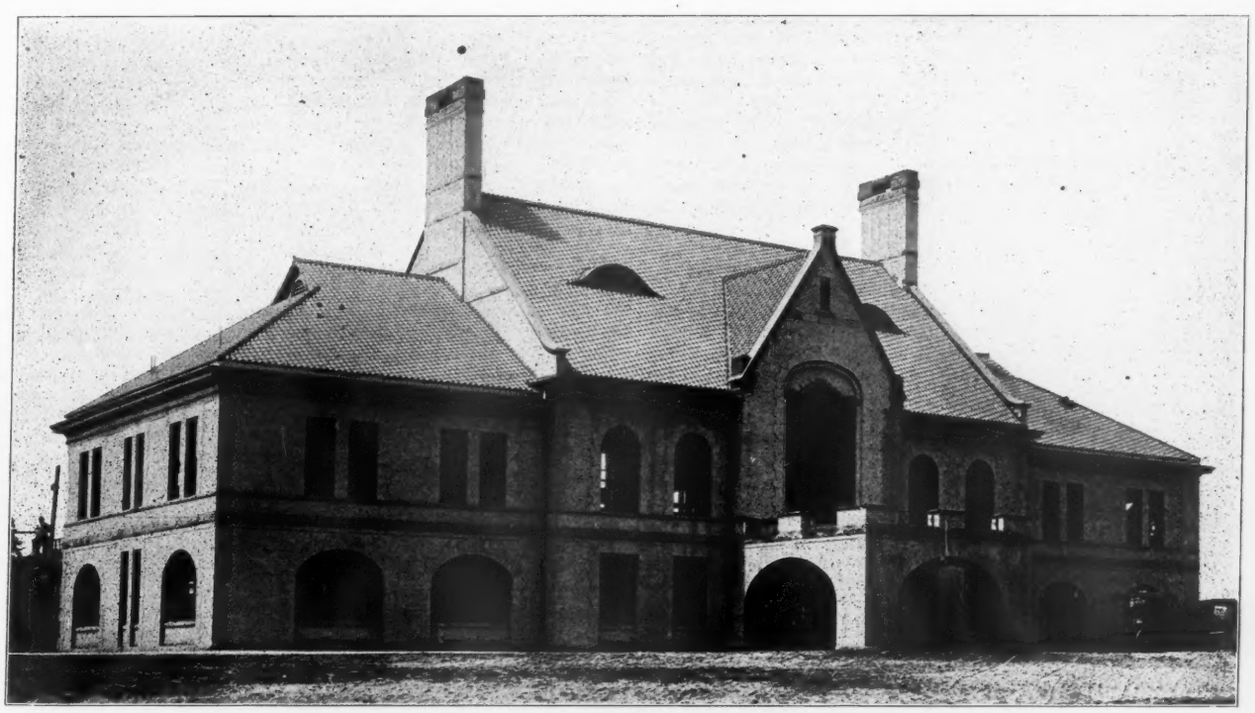
The essential requisites are when to stop, what to do after a stop has been made, when and how to proceed and what route to take, regardless, in a measure at least, of whether the control is exercised on account of the condition or occupation of the track. A careful study of the foregoing suggestions for standard practice, taken in connection with the rules and regulations of the American Railway Association, will, I think, sufficiently indicate a comprehensive plan of securing the desired results with a minimum change in the present practice on any line interested, and at the same time eliminating any unnecessary special knowledge or undue exercise of memory on the part of enginemen.

OFFICER.

New Station of the B. & O. at Youngstown, Ohio.

The Baltimore & Ohio is completing a new passenger station at Youngstown, Ohio. The intention to rebuild its passenger stations all over the system as fast as possible was announced some time ago, and the Youngstown station is the first built in the execution of this policy.

The building follows the antique German style. It is 148 ft. long by 50 ft. wide and is two stories high. The tracks are on a level with the second story, which leaves the railroad facade one story high, while the main facade is two stories high. A wide driveway of limestone with a 10-ft. cement walk, fringed with a lawn and flower beds, leads from Mahoning avenue to the station. The building material is gray pressed brick with brown sandstone trimmings. The interior is finished with quartered oak with a marble mosaic floor in the main waiting room. The roof is covered with red tile of Spanish design. The spacious platforms between the tracks are protected by steel umbrella sheds with red tile roofs. The general waiting room, which occupies the center of the building and is two stories high, has accommodations for seating 150 people. Connecting with it on the main floor are the ticket office, news stand and telephone and telegraph booths. The women's retiring room, men's smoking room, baggage room and various offices of the railroad company are on the second floor. There is a subway leading from the general waiting room to each track, which relieves passengers of the necessity of crossing the tracks in going to and from trains.



New Passenger Station of the Baltimore & Ohio R. R. at Youngstown, Ohio.

Governmental vs. Private Ownership of Public Utilities.

A CONTRAST, IN THE EXPERIENCE OF THE STATE OF ILLINOIS.

In much, if not all that has been spoken or written on Governmental, state or municipal ownership of public utilities there has been a tendency to advance theories rather than to cite facts as to known cases of success or failure. This is especially true as to our own State of Illinois, the history of which, with one possible exception, records nothing but failures, wherever and whenever governmental ownership has been tried.

In its earlier years, Illinois tried public ownership in various business experiments, among the most important of which were the internal improvement schemes, including the banking enterprises, which figured so largely in and about the year 1837. All collapsed with heavy loss and almost no tangible result, and in 1842, the state was on the verge of total bankruptcy and repudiation, having previously defaulted in the payment of interest on its bonds, said default continuing until 1853, if not later, the state debt reaching on Jan. 1, 1853, by accretions of unpaid interest, its highest point—$16,724,177.

For the history of the internal improvement craze, the subsequent period of financial depression and insolvency, with sundry references to the state's experience in operating state banks, we are indebted largely to John Moses' History of Illinois.

The most exciting subject of discussion in the session of the Second General Assembly in December, 1820, was the passage of a law to escape existing financial difficulties. A state bank was chartered, based entirely on the credit of the state, to be located at Vandalia, with branches at Shawneetown, Edwardsville and Brownsville. Notes of various denominations were authorized to be issued, bearing 2 per cent. interest per annum, payable by the state in ten years, and the banks were directed to loan the bills to the people in sums of not less than $100 on personal security. These banks were at first very popular, everybody being accommodated without much regard for the kind of security offered—$300,000 was soon in circulation. In the meantime, payments of loans were uncertain—no such thing as redemption being thought of, and the bills gradually decreased in value until not worth over 30 cents on the dollar. In 1825 the state issued auditor's warrants at the rate of three dollars for one, to defray current expenses, and lost about $75,000, which expensive system must have cost the state altogether nearly a sum at least equal to the amount of bills issued by the banks, $300,000.

During Governor Cole's administration (1822 to 1826) the financial condition of the state had grown rapidly worse, the public expenses having nominally increased three-fold by reason of the depreciation of the state bank paper. In the winter of 1830-31, the Legislature passed a law authorizing the state to borrow $100,000 to redeem outstanding circulation of the old State Bank. The Bank of the State of Illinois was incorporated in the winter of 1834-35.

Governor Duncan, in his message to the Ninth General Assembly (second session), referring to the demand for internal improvement said, "I would most respectfully suggest the propriety of leaving the construction of all such works . . . to individual enterprise."

In the winter and spring of 1836, there was almost a universal demand on the part of the people for various forms of internal improvements, and at one of the most important meetings held in Vandalia, attended by delegates from all over the state, the legislature was urged to act without delay. Stephen A. Douglas was the first member to introduce a series of resolutions specifically describing improvements to be constructed and owned by the state, and recommended the loan of millions of dollars to be negotiated on the faith of the state. A bill embodying substantially the plan recommended was finally passed February 27th. The Governor in returning the bill with his objections again expressed his well-known views, "*that such works, in his opinion, could only be safely and economically consummated by independent corporations.*" The more important of the proposed public works were the following railroads:

The "Central Railroad", from Cairo to Galena	$3,500,000
Branch of "Central Railroad" to Terre Haute	650,000
Alton to Mt. Carmel	1,600,000
"Northern Cross" Railroad	1,800,000
Peoria to Warsaw	700,000
From Alton to connect with "Central" R. R.	600,000
Belleville to Mt. Carmel	150,000
Bloomington to Mackinaw Town	350,000

Before adjourning, the Tenth General Assembly also passed laws increasing the capital stock of the State Bank $2,000,000, and that of the Shawneetown Branch Bank $1,400,000.

There immediately followed an era of unprecedented speculation, which advanced in intensity until, when, the advocates of an advanced system of improved transportation, beheld in the passage of the above described act, the materialization of their wildest dreams, the fever developed into mania and the folly of inflation held high carnival. Soon after the Illinois banks were forced, as were other banks throughout the United States, to suspend specie payments, and as the law incorporating these Illinois banks provided that if they refused specie payments for 60 consecutive days they should forfeit charter privileges, the Governor called a special session of the Legislature and a bill legalizing the suspension was passed, although another bill to repeal the internal improvement system was laid on the table.

Governor Duncan's administration began in 1834, with the state debt $217,000. At its close, December, 1838, the debt had increased to $6,688,000, including:

Bonds sold for bank stock	$2,665,000
Bonds for internal improvements	2,204,000
Bonds for canal construction	1,000,000

The Governor, in his valedictory message, again emphasized his opposition to the internal improvement system, and again recommended that "*all such works be left to the prosecution of individual citizens of the state or to corporations created by law.*"

Sentiment in the Legislature as to internal improvements was with the incoming Governor (Carlin), and with the retiring Governor as to banks. All efforts to repeal or modify the internal improvement system failed, but resolutions in favor of the expediency and constitutionality of a national bank were adopted.

On Dec. 1, 1839, the state debt presented the following appalling appearance:

Bonds sold to the State Banks, invested as capital therein	$2,665,000
Internal improvement bonds, sold in the U. S. and London	4,687,000
Canal bonds sold	3,400,000
Due to contractors and interest on loans	1,458,000
Other items	1,020,550
Total	$13,230,550

In the fall of 1839, the people began to express dissatisfaction at the outlook of state affairs, and public meetings were held in 15 counties. A special session of the Legislature was finally called to "consider the grave crisis" and laws were passed which abrogated the entire system. Thus came to a disastrous conclusion in Illinois *the attempt of the Commonwealth to own a system of public improvements.* As a result of these stupendous schemes, only a portion of one of the projected improvements was completed—the railroad from Meredosia to Springfield, 51 miles. That road was leased to individuals and operated generally at a loss until 1845, when it became practically useless on account of absolute lack of maintenance. This road, which had cost the state nearly $1,000,000, was finally sold at public auction for $21,000.

That a body of lawmakers could be found who could be induced to sanction a system so crude in inception, so extravagant in dimensions and so impracticable in details, is hard to understand, although their actions cannot be ascribed to any lack of earnest conviction or genuine integrity of purpose, but rather to headlong rashness, due to want of experience in affairs. In the selection of routes, clear foresight and sound judgment were shown, all the lines marked out having long since, through private enterprise, become important and successful arteries of commerce.

The attention of the legislature was again called to the state debt by Governor Edwards in November, 1840, the amount being stated as $12,307,182, and the annual interest charge thereon $732,430. The Governor set forth clearly and fairly the embarrassing situation, admitting the extravagance and error which had attended this attempt at state ownership. Some members were, however, still in favor of at least completing the "Central" and "Northern Cross" railroads, while others were opposed to doing any more work, and still a few others even favoring repudiation. Entering into the controversy were questions relating to the state banks, which had again suspended specie payments. Ever since the abandonment of the internal improvement schemes, the state had been passing through a remarkable period of financial depression. In February, 1842, the state bank, followed in June by the Shawneetown bank, "exploded with a great crash." Over $3,000,000 of the paper of these banks depreciated until it was worth only 50 cents on the dollar. The state debt, including interest, was in December, 1842, estimated by Isaac N. Arnold, of the House Finance Committee, to amount to $15,657,950. Public men of all parties stood appalled by the financial problems which confronted them. At the Democratic state convention in June a resolution against repudiation was laid on the table.

Among the bills passed by the Thirteenth General Assembly were the compromise bills, drawn by the Governor, requiring the State Bank and its Shawneetown branch to go into liquidation. Companies were also chartered to complete the "Central" and "Northern Cross" railroads, but the incorporators failed to comply with the terms imposed by the state.

A more complete appreciation of the financial depression during the period 1830-1848, may be had from the following statement showing the state debt during the years named:

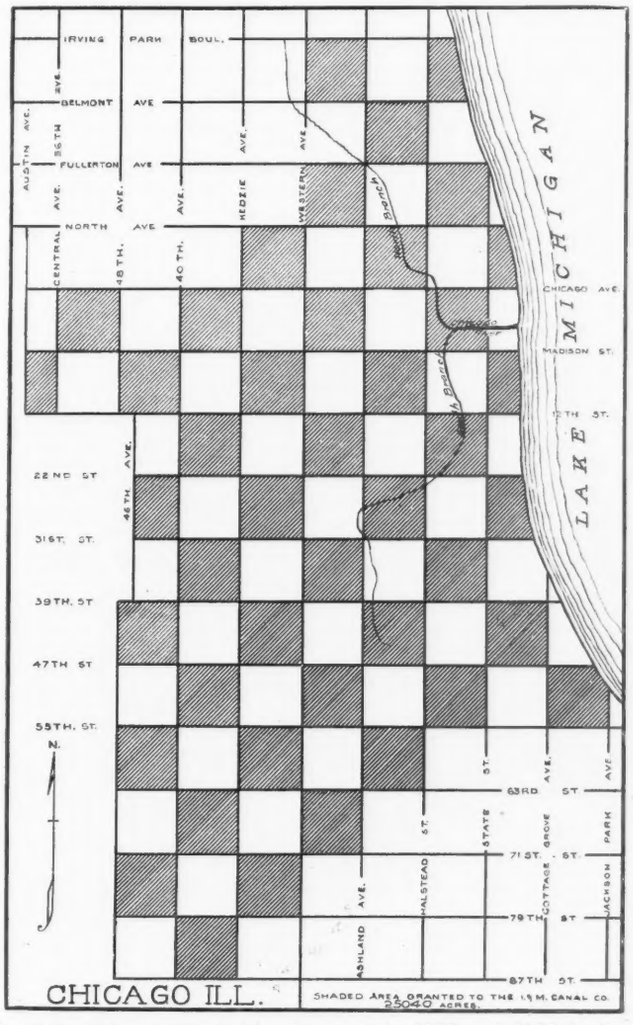
1830-32 $150,000	1836-38 $6,688,784	1842-44 $14,633,969
1832-34 267,000	1838-40 13,039,572	1844-46 16,389,817
1834-36 378,286	1840-42 15,657,950	1846-48 16,661,795

On Jan. 1, 1853, the debt amounted to $16,724,177—its highest point.

To summarize: The system of internal improvements contemplated the building of 1,342 miles of railroad at a cost of $12,000,000.

Before repeal the state was unable to pay the interest on its bonds. The credit of the state was a by-word all over the commercial world, and the people were driven almost to the extremity of repudiation. During the period 1839 to 1847 hard times and high taxes made capital and settlers absolutely shun the state. Nearly ten years after the system had been repealed, i.e., in 1850, but 110 of the 1,342 miles contemplated had been built. Most of the work seems to have been done on the rivers, but for the debt of $12,000,000 the people received practically nothing.

The second constitutional convention was held in 1847, and the new constitution submitted to popular vote and ratified in March, 1848. One of its most important articles was No. XV., providing for a two mill tax, the avails of which were to be exclusively applied to the payment of the state's indebtedness, other than canal and school indebtedness. Thus was the tendency in the public mind to honorably liquidate the vast debt created under the internal improvement system strengthened, and the matter placed beyond the power of legislative tinkering. There still, however, existed an active minority favoring whole or partial repudiation.



Land in Chicago Granted by Congress in 1829 and 1833 to the State for a Canal or Railroad from Lake Michigan to Illinois River.

Having outlined the physical and financial failure of Illinois in its attempt at state ownership of banks and railroads, we will consider its one enterprise which at any time attained any degree of success, however partial, the Illinois and Michigan Canal, and by contrast, the realization of the state's early dream of a "Central Railroad," worked out by private capital and private ownership under the charter of the Illinois Central Railroad Company.

The Illinois and Michigan Canal is an artificial water-way, constructed and owned by the state, extending from Chicago to La Salle, and connecting the Chicago and Illinois rivers, and is stated to be about 96 miles in length.

More than 200 years ago, the earliest French explorers of Illinois claimed the feasibility of such a water-way. In 1801, Albert Gallatin recommended in a report to the Federal Congress its construction, and in 1811 a bill for its construction was introduced in Congress, a Governmental survey being made in 1816. On the admission of Illinois to the Union, the attention of the state authorities was directed to the enterprise.

By an Act of Congress approved March 30, 1822, the state was authorized to survey and mark through public lands the route of a canal to connect the Illinois river with the southern bend of Lake Michigan, 90 ft. on each side of the canal to be reserved and vested in the state for such purpose.

In 1823, Commissioners were appointed by the state and $6,000 appropriated for investigation and survey. In 1825, a canal company (the Illinois and Michigan Canal Association), with a 50 year franchise, was incorporated by the General Assembly, with authority to build and operate the canal. The company did nothing and its charter was repealed in 1826.

The state petitioned Congress for a grant of land to aid in the construction of a canal, then estimated to cost $600,000. By an Act of Congress, approved March 2, 1827, there was granted to the State of Illinois, for the purpose of aiding in opening a canal to connect the waters of the Illinois river with Lake Michigan, a quantity of land equal to one-half of five sections in width on each side of the canal (alternate sections being reserved to the United States) from one end of the canal to the other. The canal was to be begun in five years and completed in 20. It was further provided that the canal might be built by the state, or by "other person or persons," and that "the state might sell the lands in whole or in part," etc.

The Act of March 2, 1827, was amended by an Act approved March 2, 1833, so that the lands granted thereby might be disposed of "by the state for the purpose of making a railroad instead of a canal," and by postponing the time for completing the canal or railroad, "whichever the state should elect to build," for a period of five years, thereby fixing the time for commencing at March 2, 1837, and for completion at March 2, 1852.

Three hundred and twenty-four thousand three hundred and twenty acres in all were donated by Congress to the state for canal purposes. As will be seen by reference to the map submitted herewith, approximately 25,040 acres of this grant lay in what is now the city of Chicago, and a large part thereof in the original city. Considering their location, the statement that these lands were then and are now the most valuable in the state admits of no question.

In 1829, Commissioners were appointed to sell the canal lands and apply the proceeds to its construction. In 1833, the Canal Commission was abolished and its affairs placed with a board of state officers. Actual construction began in 1836, and in 1848, twelve years later, the canal was opened for navigation. That is to say, the state consumed in building this canal, 96 miles long, either 26 years from the time that Congress in 1822 granted a right of way, or 21 years from the time that Congress in 1827 passed the Act granting such valuable lands in aid of the canal.

The affairs of the canal were, subsequent to its completion and until May 1, 1871, administered by a Board of Trustees vested with full power to operate the canal in the interest of the holders of the securities issued by the state until all such indebtedness should be wiped out, etc., and thereafter by commissioners appointed by the Governor; or say, in effect by receivers in trust for the state's obligations, which at the opening of the canal were, and had been for years, in default.

It is stated in the Illinois Blue Book, 1903, that the canal cost $6,000,000, or ten times the original estimate; also that an additional $6,000,000 has, since 1852, been spent for improvements and repairs. As nearly as can be ascertained from the records in the office of the State Auditor, the Legislature authorized the following issues of bonds in aid of the canal, interest not to exceed 6 per cent.:

1836—On the State's credit	$500,000	
1837—On the State's credit	300,000	
1839—On the State's credit	4,000,000	
		$4,800,000.00
1843—Canal property as security	$1,600,000.00	
1847—Canal property as security	70,730.91	
		1,670,730.91
Total		$6,470,730.91

In explanation of the fact that the above exceeds the amount stated to have been the total cost of the canal, including the proceeds from the sale of canal lands, it is suggested that such proceeds were used to some extent to pay the interest on and the principal of the bonds. Possibly the whole issue was not sold.

However, for the purpose of argument from a conservative standpoint, we will assume the original cost of the canal as $6,000,000, against which the state issued obligations bearing 6 per cent. interest, calling for an annual interest payment of $360,000, regardless of sinking fund for their redemption.

From the Chicago Board of Trade report for the year 1904, p. 106, the following results of operating the canal are shown:

For the whole period of 55 years, 1850 to 1904, inclusive,

The tolls amounted to	$6,427,566
And the gross expenses to	4,594,991
Excess of tolls over expenses in 55 years	$1,832,575

or $33,320 per annum, which is but little over one-half of 1 per cent. per annum on $6,000,000.

While it is true that in each of the 27 years from 1850 to 1876 inclusive, the tolls exceeded the expenses, and that the

Tolls amounted in those years to.....	$5,036,176
And the gross expenses	2,221,761
Leaving an excess for those 27 years.....	$2,814,415

or $104,238 per annum, such excess instead of providing the 6 per cent. interest payable on the bonds and a proper sinking fund for their retirement, did not provide 1¾ per cent. per annum on the $6,000,000.

On the other hand, in no one of the remaining 28 years, 1877 to 1904, inclusive, have the tolls equalled the gross expenses, and

In them the expenses amounted to.....	$2,373,230
And the tolls to	1,391,390
Leaving excess of expenses over tolls, last 28 yrs.	$981,840

This shows an average annual payment by the taxpayers of $35,066 for the privilege of maintaining the canal.

On Sept. 20, 1850, the State of Illinois then being and having for years been in default on its public debt, Congress passed "An Act granting the right of way, and making a grant of land in the States of Illinois, Mississippi and Alabama, in aid of the construction of a railroad from Chicago to Mobile," and the state having accepted said grant, on Feb. 10, 1851, passed "An Act to incorporate the Illinois Central Railroad Company, which begins with a preamble reading:

"Whereas, in the judgment of this General Assembly, the object of incorporating the *Central Railroad Company* cannot be attained under general laws, etc."

This taken in connection with various legislation prompted by the existing insolvency of the state, clearly shows that the people of that day had had a sufficiently disastrous experience with governmental ownership of public utilities to induce their representatives in the General Assembly to adopt the sound policy of turning the grant of lands, made by Congress in aid of the railroad, over to a private corporation.

Under the Act of Feb. 10, 1851, to incorporate the Illinois Central Railroad Company, the state reserved to itself forever, in lieu of taxes upon the 705.5 miles of railroad to be built thereunder, 7 per cent. of the gross receipts of said railroad from all sources. At that time the taxes paid by railroads in Illinois were very low, amounting to less than 1 per cent. of the gross receipts. It appears from the report of the Railroad and Warehouse Commission that during the year ended June 30, 1904, the gross receipts of all railroads in the State of Illinois, excluding the 705.5 miles built under the Illinois Central charter above referred to, amounted to $117,684,080, and that said railroads paid as taxes $3,649,576, being $3^{1}/_{10}$ *per cent.* upon their gross receipts.

The report of the Chicago Board of Trade for 1904 shows (at page 164) that from 1855 to Oct. 31, 1904, the amount paid by the Illinois Central Railroad Company into the State Treasury, in accordance with the provisions of its charter, was $22,730,529.53, and that the amount so paid for the year ended Oct. 31, 1904, was $1,062,571.86. Deducting therefrom three and one-tenth per cent. upon $15,179,598.09, which, as stated in the said official report, were in that year the gross receipts of the 705.5 miles of railroad built under the Illinois Central charter, there remains as the profit made by the State of Illinois in that single year by turning over the Congressional grant in aid of the railroad to a private company, over and above what ordinary taxes on the railroad would have amounted to, the sum of $592,004.32.

But from the point of view of the public, the real question is, how much service did the Illinois Central Railroad Company render on those 705.5 miles of railroad during the year 1904, in the transportation of passengers and freight and at what rates?

There were carried over the 705.5 miles of the Illinois Central Railroad which were built under its original charter (Act of Feb. 10, 1851), during the year ended June 30, 1904, 15,184,414 passengers for an average distance of 12.78 miles, making 193,998,218 passengers carried one mile, and 12,280,327 tons of freight for an average distance of 179.70 miles, making 2,206,777,585 tons carried one mile.

For this service the company received an average rate per passenger per mile of 1.79 cents, and an average rate per ton per mile of less than half a cent, or to be exact, .482 cent per ton per mile.

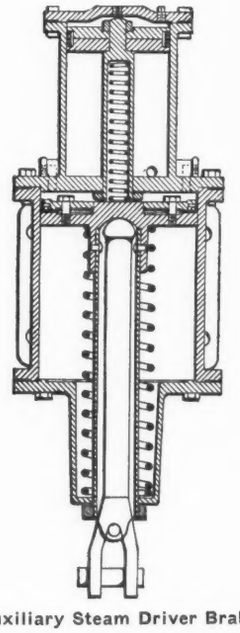
We have, therefore, as a guide for the future, this experience in the past with regard to state ownership of public utilities. The Illinois and Michigan Canal (96 miles in length) cost the state at the outset $6,000,000. Under state ownership and state management it has in the 55 years failed to pay an average return of 1¾ per cent. on its original cost, and in each of the past 28 years, it has annually cost the taxpayers for bare maintenance more than it has brought in, regardless of interest on its cost. It carries practically no passengers and an utterly insignificant tonnage, and has ceased to be a public utility.

The Illinois Central Railroad (705.5 miles in length) was built by private capital to which the state contributed no pecuniary assistance. Under the ownership and management of a private corporation it has paid to the state in the past 50 years more than twenty-two and a half millions of dollars, having in the last year, 1904, alone returned to the state more than $592,004 *in excess* of what ordinary taxes would have amounted to, and having in that year moved 1,263 times as many tons of freight one mile as were moved on the canal, and having rendered that service as well as its very large passenger service at the exceedingly low rates heretofore stated.

We should be glad to hear from the advocates of governmental ownership of public utilities of any instance which they can give from authentic records as above, where it can be shown that Government ownership and Goverment management of public utilities have resulted in a fair return upon the capital invested, after deducting current expenses and proper allowance for taxes.

A Steam Auxiliary Driver Brake Attachment.

The San Antonio & Aransas Pass is equipping its freight locomotives with an auxiliary steam brake attachment designed by the Superintendent of Motive Power and Machinery, Mr. G. W. Butcher. A sectional view of the device is shown herewith, from which it will be seen that it consists merely in the addition of a steam cylinder tandem to the air driver-brake cylinder. The arrangement is such that the brake may be operated independently by air or by steam.



Auxiliary Steam Driver Brake

The primary purpose of the attachment is for use in such emergencies as an air pump failure, or for holding the brake while recharging on a heavy grade. Also it provides a safety feature at terminals while men are working under the locomotive. The steam cylinder can be cut in and the brakes will hold as long as there is steam in the boiler.

The attachment requires the removal of the brake cylinder head, which it replaces. Some extra piping and a three-way cock in the cab completes the application. Mr. Butcher has patented the device.

The Cost of Locomotive Operation.

XIII.

BY GEORGE R. HENDERSON.

RENEWALS.

(*Continued from page 274.*)

This may or may not be an operating charge, depending upon the policy of the road. In the strict sense of the term "renewal" it would be an operating expense pure and simple, that is, if new locomotives were purchased only as the old ones were worn out. The actual life of a locomotive is a very uncertain thing to compute. The author recently saw an engine 38 years old that had just been withdrawn from active service, having the original rods, frames, etc., and in England engines are said to be running in the neighborhood of 50 years old. Generally in this country, when a locomotive is 20 years old, it is supposed to have reached the limit beyond which it is not considered policy to spend much money for repairs, and if the same size and price of engine were purchased with which to replace it, an annual charge of 5 per cent. would create sufficient funds to effect a renewal at the end of the 20 year period. This would be a true renewal charge, and should be added to the ordinary cost of repairs. If the cost price of the engine were $10,000, and a mileage of 50,000 were made per year, we should have an addition of $\frac{10{,}000.00 \times .05}{50{,}000} = .01$ or 1 cent a mile to the repair charges to take care of the regular renewals. But renewals are never handled in just this manner. The new locomotive invariably is larger and costs more money than its earlier prototype, and this in itself constitutes a betterment, instead of an ordinary renewal.

On some lines it is the avowed policy to scrap a certain num-

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ber of old engines every year, it, of course, being ascertained that there are a large number that are worn out or antiquated and of questionable service value. When the scrap engines are so reported each month, an arbitrary amount, in one case known to the author, of $17,000 an engine, is charged to the repair account and credited to a replacement fund. It is evident that such an amount as that named above is far in excess of the original cost of the engines which it is used to replace, and if the number scrapped each year be large and the average mileage small, the charges against the repair account may easily reach 2 or 3 cents per mile over and above the normal or actual cost of repairs. There is no criticism intended of the wisdom of such a policy, as it is doubtless the proper one to adopt, and many roads are burdened with a large number of "antiquated freaks" which are worth more as scrap than as motive power, but the importance of the method of replacing locomotives to the cost of repairs must not be overlooked, and it should always be considered in making comparisons of one road with another.

Very often it is not stated in the reports whether replacement figures are included in the repair charges or not, and this fact shows the uselessness of compiling large quantities of statistics when the method of computing them is not known, nor is it even at all likely that they have been worked up on the same basis. While 20 years has been referred to as the probable limit of useful life of a locomotive, it, of course, should be more a question of service than of years. On very few roads will the average annual mileage of all the locomotives exceed 50,000, although some engines may make 8,000 or 10,000 miles a month. The author remembers when engine 1,001 made two round trips a day on the Pennsylvania Railroad between Harrisburg and Altoona, as an experiment, and kept this up for a number of months. This amounted to 15,000 miles a month. Very frequently schedules are so arranged that a round trip of 150 miles, and in some cases 200 miles each way, can be covered every 24 hours in passenger service. This would correspond to 9,000 or 12,000 miles a month, as the case might be. Under such conditions we should expect these engines to wear out twice or three times as fast as the average for all the engines, and although they would have to be replaced that much sooner, the cost of such renewals, distributed over the mileage performed, would be no greater per mile run. Fifty thousand miles a year for 20 years would make a total of 1,000,000 miles, and if some engines ran 9,000 miles a month, they would reach this figure in about 10 years. The road could just as well afford to replace them then, as to wait 20 years at one-half the annual mileage, and better, because if such service were obtained from all the engines, it is evident that only one-half as many would be needed to operate the road, and only one-half as much capital would be tied up in equipment of this kind. The author believes in wearing locomotives out as fast as possible. By this he does not mean wearing them out by improper treatment or careless maintenance, but by the legitimate work of hauling trains. The faster they can be worn out the sooner they will be replaced with modern machines, and the strides made in the power and type of locomotives in the last few years have been such that an engine only 10 years old is of comparatively little use, except for branch service. It is very much better, if it be possible to so operate the road, to have, say, 50 engines which must be replaced in 10 years, than to have 100 stay in service for 20 years. This is what is meant by wearing them out as fast as possible, so as to reap the benefits of new and improved power.

But there is still another phase to the question which can best be illustrated by an actual case. An important line, having a number of 1 and 1¼ per cent. grades, was operated with power so light that only short trains could be hauled, or of respectable length by double heading. An analysis was made of the freight train movement for a calendar year, and it was found that if 20 new engines of larger size were purchased the saving in engine crew and train crew mileage in one year would be sufficient to pay the cost of the 20 new locomotives. It was no doubt good policy to make the substitution, and as the line in question was part of a large system, the lighter engines thus replaced could be used or other portions with easier gradients, but the difference between the price of the new engines and the credit received from the old ones would constitute a very large addition to the repair account, unless the difference were charged as a betterment to capital account, where it really belonged. Some roads like the Pennsylvania are continually improving the property and adding to its initial value out of the profits, all of which is sound business, but if these betterments are charged to repair accounts, as they often are, it is absolutely useless to compare operating expenses between different roads or different periods.

Apropos of this discussion a number of new and powerful passenger engines were put on a part of one of our western systems, displacing lighter engines, which were sent to other territories. These being replacements were naturally charged to the repair account. The first year that they were in service, each locomotive saved $5,000 by reducing the number of sections and double headers. This saving naturally accrued to the credit of the transportation department, as it was principally in train crew wages, but motive power costs had risen by the charges made against maintenance to provide for the purchase of the engines.

There are still other times when renewals are required, that is, when from collisions or wrecks the locomotives are either destroyed or so badly damaged that it will not pay to repair them. Such incidents throw heavy charges into repair accounts.

Rebuilding of locomotives, such as the application of larger boilers, cylinders or wheels, constitute what may be termed extraordinary repairs, and will greatly increase the cost, unless specifically treated. Even the application of driver or truck brakes, if introduced very generally for a year or so, will add quite a perceptible figure to the repair account. Where statements are regularly prepared and are used for comparisons it is advisable and proper to state whether wreck repairs, extraordinary repairs and renewal fund charges are included in the regular repair expenses, and if so, what they amount to, otherwise the comparisons of one year with another are valueless. As an example of how the repair figures may be affected by such charges, a large western road for one month had a *real* locomotive repair account of $90,000. During the same month there were charged to repairs and credited to the replacement fund $35,000, or 40 per cent.! Another road included $6,300 of wreck repairs in a total of $48,000, so that the wreck damage cost one-eighth of the total repairs for the month.

Under these conditions it is evidently impossible to make any general estimates which are likely to conform to the ordinarily published statements of the cost of repairs, as so much depends upon the policy pursued. It is no doubt fair to allow an ordinary amount, such as one cent a mile for renewals, but it would be out of the question to attempt to carry wholesale purchases of heavier power by any arbitrary figure that might be assigned without knowing the detailed operations and methods followed.

(To be continued.)

Cross-Tie Record of the Santa Fe.

E. O. Faulkner, Manager of the Tie and Timber Department of the Atchison, Topeka & Santa Fe, has prepared his regular semi-annual statement, for the first six months of 1905, of the tie insertions for the period mentioned and the removals for the entire period over which records have been kept. The figures for removals are given by divisions and by years, the reasons for removal being noted and the average life of the ties computed in each case. The following tables are made up from the information contained in the statement.

TIES REMOVED.

	Treated			Untreated			Av. life of treated ties, yrs.
	Rotten.	Other causes.	Total.	Rotten.	Other causes.	Total.	
Eastern Grand Division.							
Illinois Div.	748	19	767	58,181	190	58,371	5.5
Missouri Div.	3,840	219	4,059	52,936	200	53,136	5.0
Kansas ICty Div.	513	1	514	9,067	.....	9,067	5.9
Eastern Div.	1,830	561	2,391	79,589	1,869	81,458	5.9
Middle Div.	11,936	209	12,145	110,054	902	110,956	6.8
So. Kansas Div.	6,174	1,571	7,745	131,900	6,700	138,600	6.2
Okalhoma Div.*	15,557	35	15,592	54,657	.....	54,657	7.2
Western Grand Division.							
Western Div.	12,716	374	13,090	78,197	1,748	79,945	10.9
Pan Handle Div.	3,015	347	3,362	88,029	1,176	89,205	6.7
Colorado Div.	8,893	188	9,081	17,815	504	18,319	10.9
New Mexico Div.	40,183	2,156	42,339	9,401	866	10,267	10.9
Rio Grande Div.	33,589	743	34,332	8,922	831	9,753	15.1

*Including Eastern Oklahoma Ry.

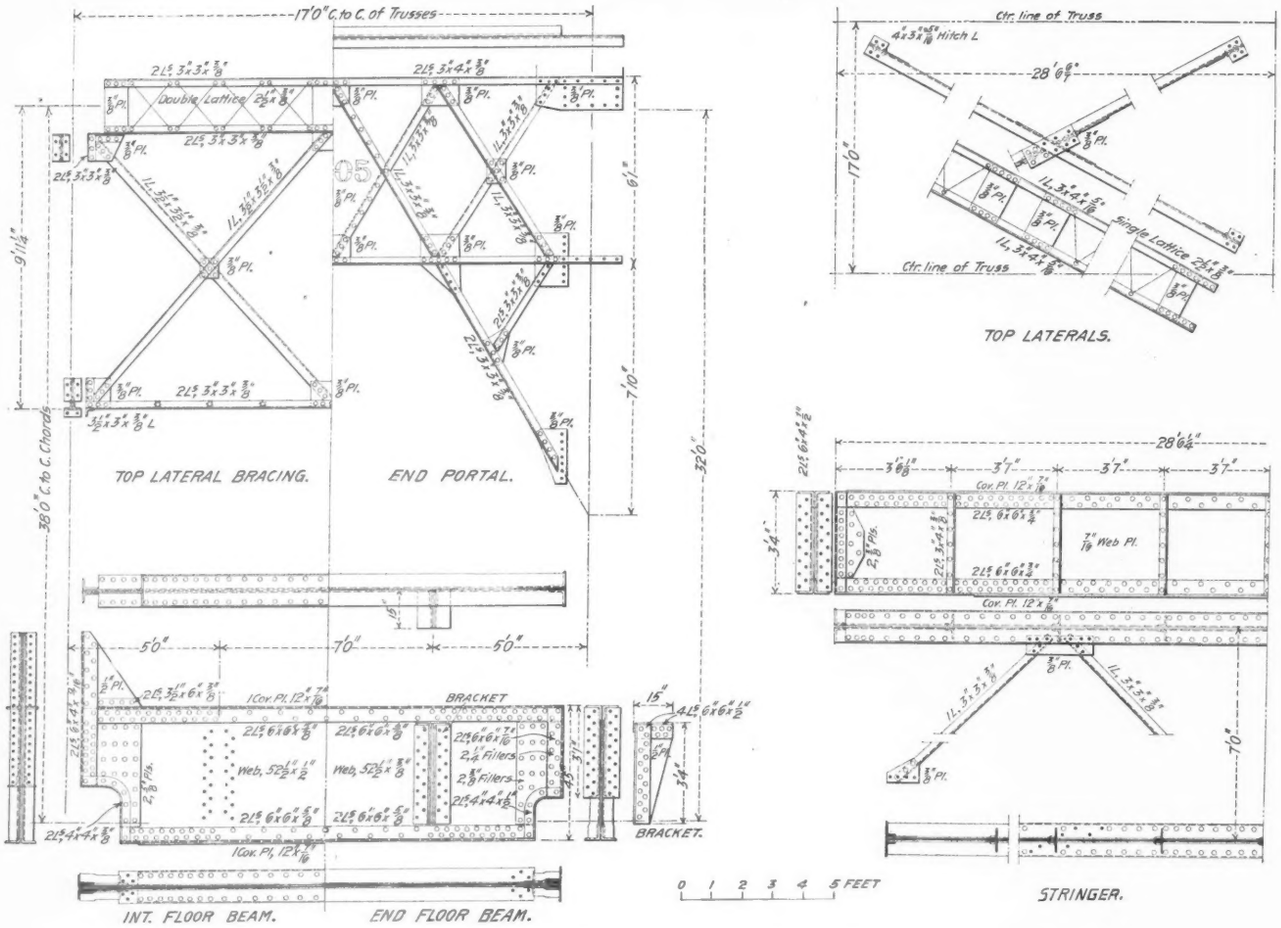
Ties Inserted.

Eastern Grand Division.	Treated.	Untreated.	Total.
Illinois Division	111,894	111	112,005
Missouri Division	72,048	1,605	73,653
Kansas City Division	29,093	.....	29,093
Eastern Division	110,002	830	110,832
Middle Division	124,041	219	124,260
Southern Kansas Division	190,219	.....	190,219
Oklahoma Division	70,891	.....	70,891
Total	708,188	2,765	710,953
Western Grand Division.			
Western Division	111,090	1,095	112,185
Pan Handle Division	95,197	.....	95,197
Colorado Division	32,958	.....	32,958
New Mexico Division	45,386	44,312	89,698
Rio Grande Division	52,983	394	53,377
Total	337,614	45,801	383,415

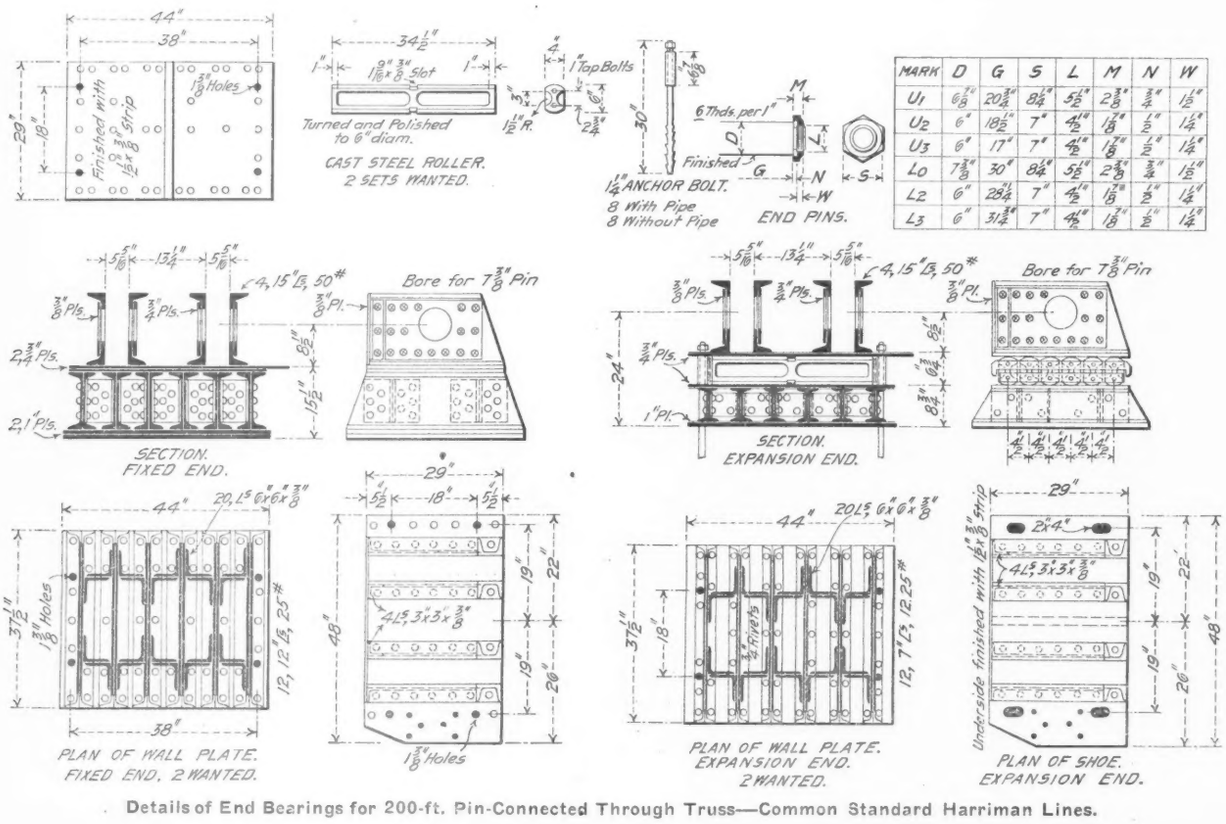
Standard Bridges on the Harriman Lines.*

The 200-ft., pin-connected span shown this week is the longest of the standard designs for the Harriman Lines. The principal differences in its design over the 180-ft. span shown September 22, are in the substitution of a partly curved top chord for the straight top chord of the Pratt truss and in the fabrication of the verticals. The details of the end bearings have also been changed somewhat

*Previous articles appeared in the *Railroad Gazette* March 17, 24, 31, April 7, 14, 21, 28, July 28, August 11, 18, 25, Sept. 1, 8, 15 and 22.

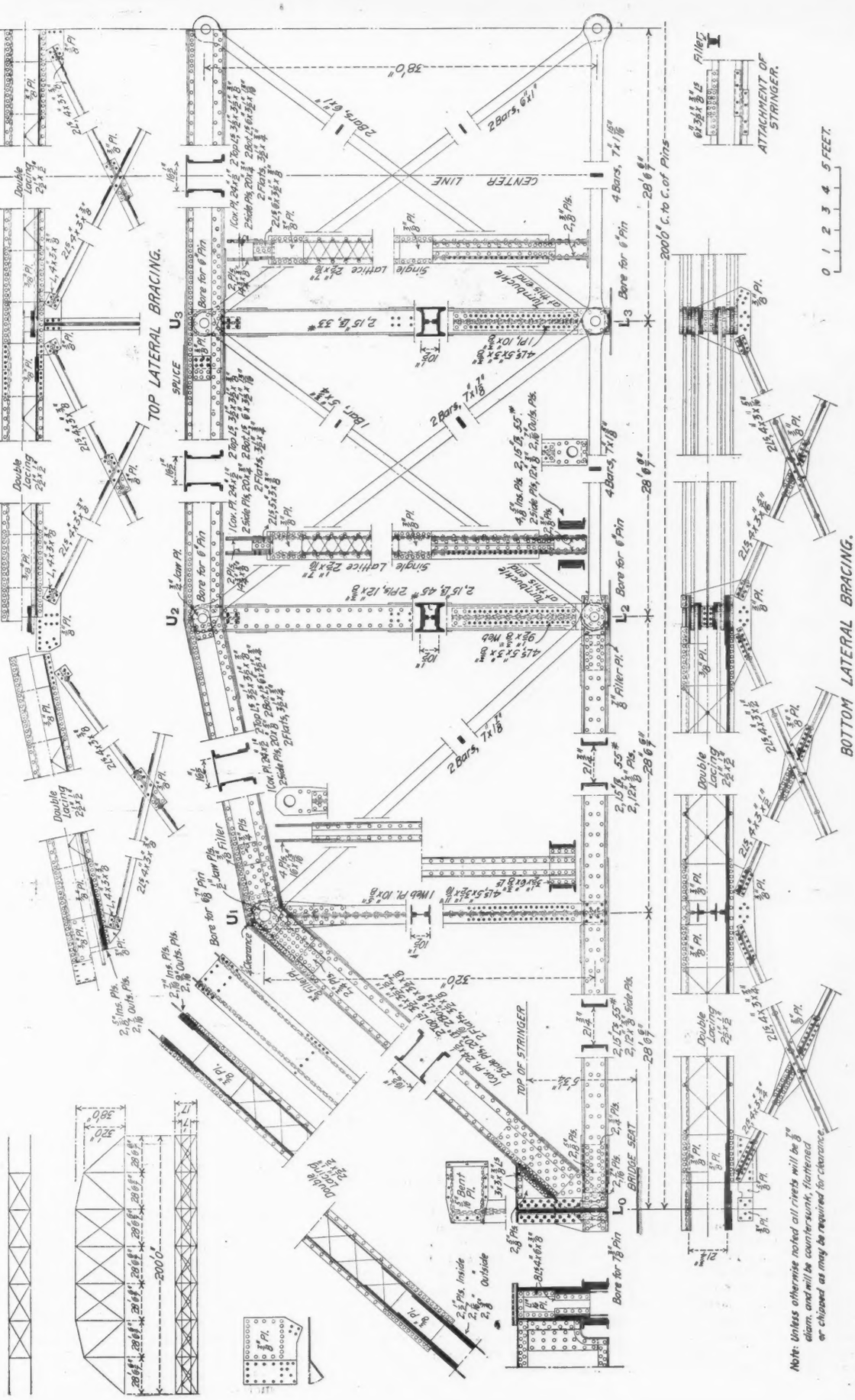


Details of Floor and Lateral Bracing of 200-ft. Pin-Connected Through Truss—Common Standard, Harriman Lines.



MARK	D	G	S	L	M	N	W
U1	6⅞"	20¾"	8¼"	5½"	2⅜"	¾"	½"
U2	6"	18½"	7"	4½"	1⅞"	½"	¼"
U3	6"	17"	7"	4½"	1⅞"	½"	¼"
L0	7⅛"	30"	8¼"	5½"	2⅜"	¾"	½"
L2	6"	28¼"	7"	4½"	1⅞"	½"	¼"
L3	6"	31¼"	7"	4½"	1⅞"	½"	¼"

Details of End Bearings for 200-ft. Pin-Connected Through Truss—Common Standard Harriman Lines.



Details of Trusses for 200-ft. Pin-Connected Through Span—Common Standard, Harriman Lines.

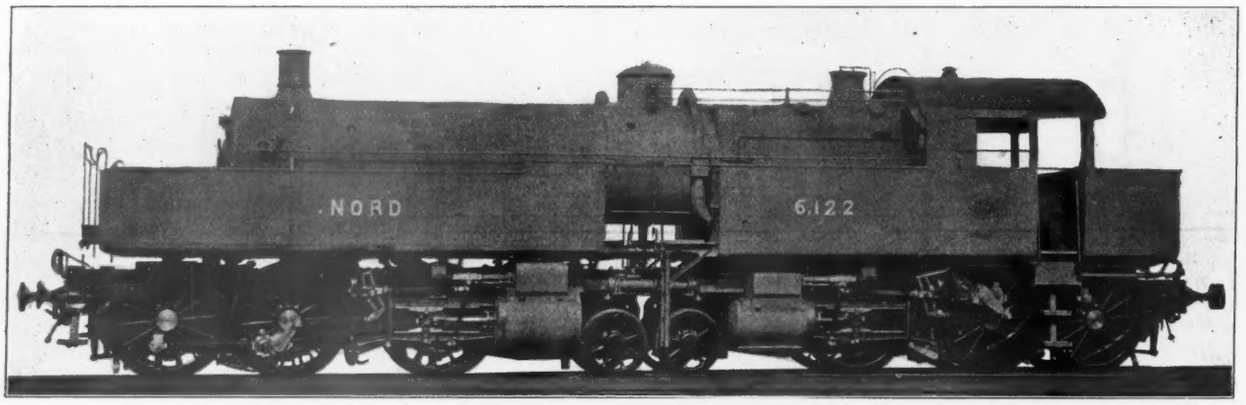
to allow for the wider packing in the bottom chord of the truss. The top lateral struts have been made deeper but of no heavier material. The estimated weight of the span is 485,000 lbs.

This article completes the series. For long crossings, skew bridges and at other places where the standard designs cannot be used special designs are, of course, worked out but the eight lengths of plate girders from 20-ft. to 100-ft. span, the five lengths of riveted through trusses from 100-ft. to 150-ft. span and the four longer pin-connected trusses from 150-ft. to 200-ft. span provide for a very large proportion of the steel bridge work which is required for railroads. These designs are the result of careful study on the part of the large number of competent engineers on the Harriman Lines and they embody the best modern practice in bridge construction. The drawings which have been shown give sufficient details of the material and dimensions to enable any engineer to utilize them as a basis of comparison for calculating new work of similar size or even as a complete general working drawing from which the shop drawings could be readily made. The young engineer will find them well worth careful study. We wish to again acknowledge our indebtedness to Mr. John D. Isaacs, Assistant Engineer of Maintenance of Way of the Southern Pacific, from whom the drawings were obtained.

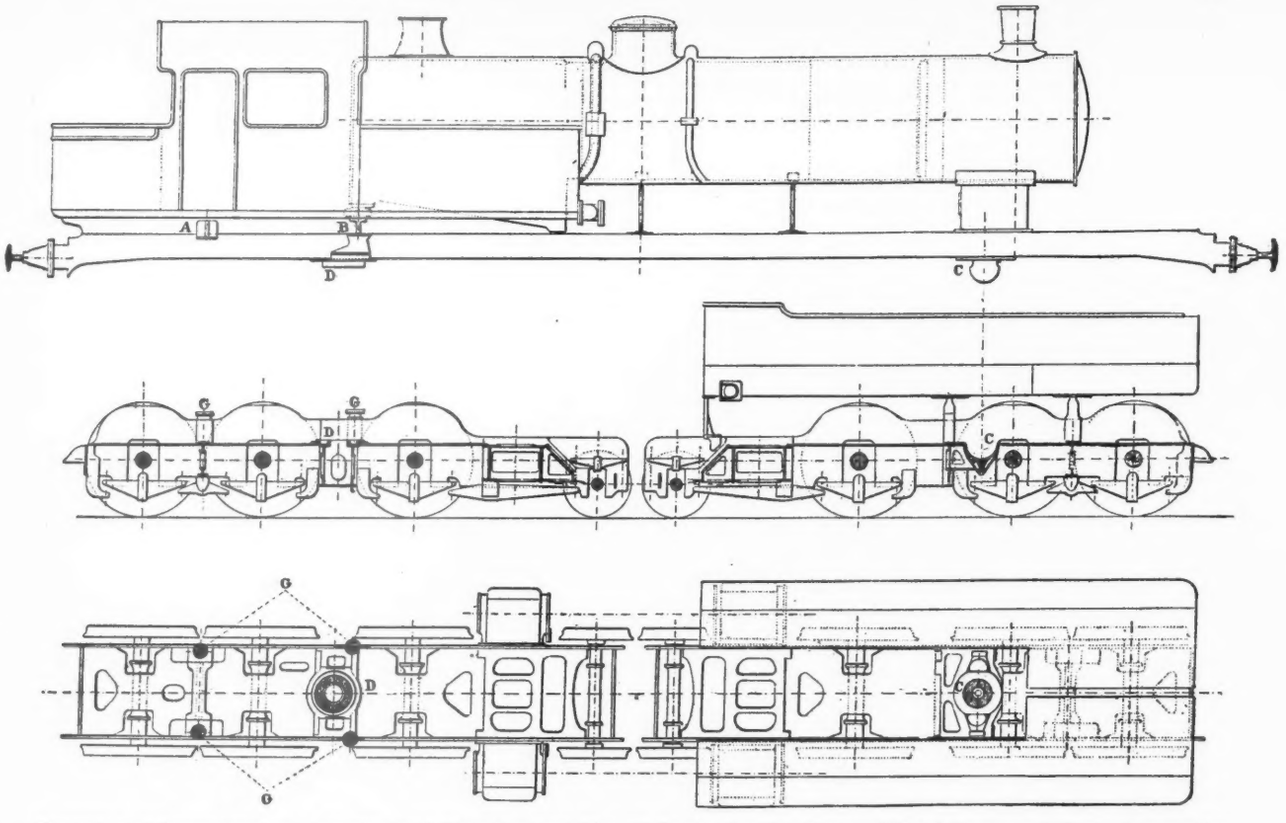
Sixteen-Wheel Double Tank Locomotive for the Northern Railway of France.

The Northern Railway of France had a locomotive at the recent Exposition at Liege, Belgium, that is a notable departure from the practice of the road. At first sight it appears to be a modification of the Mallet type, or a combination of two 2-6-0 or mogul locomotives whose frames have been brought together head on, and the two then supplied with a boiler of extraordinary length. The immediate reason for the production of this machine is to be found in the importance of the coal traffic, and the grades over which it is hauled.

This traffic has been increasing ever since 1857, when it was handled by 0-8-4 engines weighing 136,000 lbs., including the tender, of which 85,800 lbs. were on the drivers. In 1897 some 4-6-0 or 10-wheelers were built, of which the total weight of engine was 135,800 lbs., with 95,500 lbs. upon the drivers. The traffic originates in the north and is sent out over two routes. On one the curves are of long radius and the grades light (0.6 per cent.); on the second there are grades of 1.2 per cent. The trains on the latter, running by way of Valenciennes, weighed 950 tons and were handled by compound locomotives. But when they reach Valenciennes or

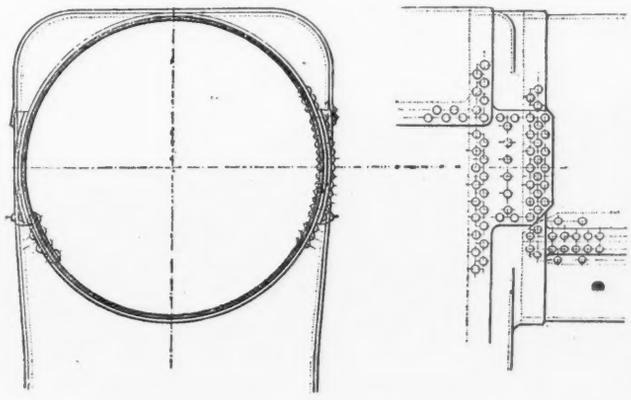


Sixteen-Wheel Compound Bogie Locomotive—Northern Railway of France.



Elevation of Superstructure, Longitudinal Elevation and Plan of Bogies for the Sixteen-Wheel Compound Bogie Locomotive Northern Railway of France.

Busigny, they had to be cut in two as the company had no engines with sufficient power to take them up the 1.2 per cent. grades to follow. It was to avoid this trouble that the engine illustrated has been designed. It was necessary in order to work the crews to the best advantage that they should be able to take the trains from Lens to Hirson via either Busigny or Valenciennes. Upon the easy portions of the run the engine is to utilize its power in speed, where it is expected to run at from 30 to 37 miles an hour, while on the heavy grades the power will be utilized in traction and the speed will be reduced to from 11 to 13 miles per hour. These conditions require that the diameter of the driving wheels shall be comparatively large (59 in.); an economical hauling power; stability at speeds that may rise as high as from 45 to 50 miles an hour, and a high tractive power. These all point to a heavy machine carried on a large number of wheels in order not to overload the track.



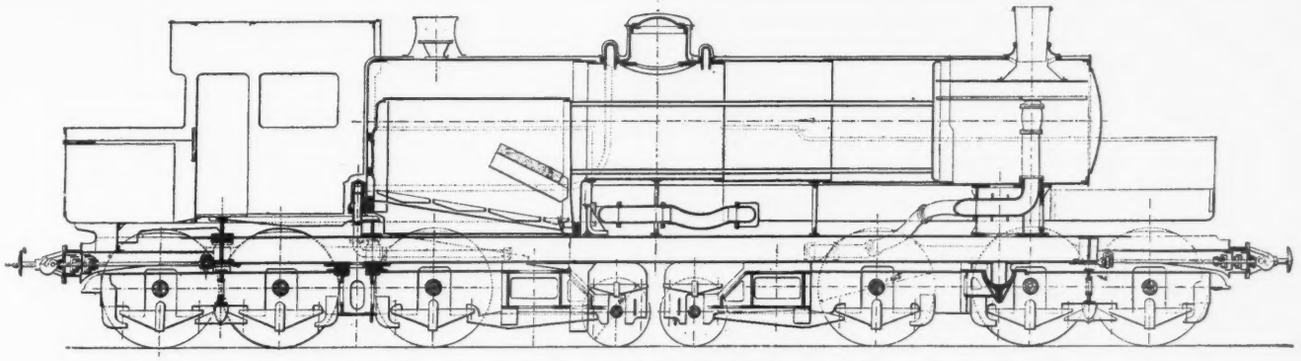
Joint Between Fire-Box and Boiler Shell.

An examination of the permanent way led to the decision that neither the load per wheel nor the present rigid wheel base should be exceeded, with the result that 6-wheeled motors and a total length of 58 ft. 6 in. between drawheads were adopted.

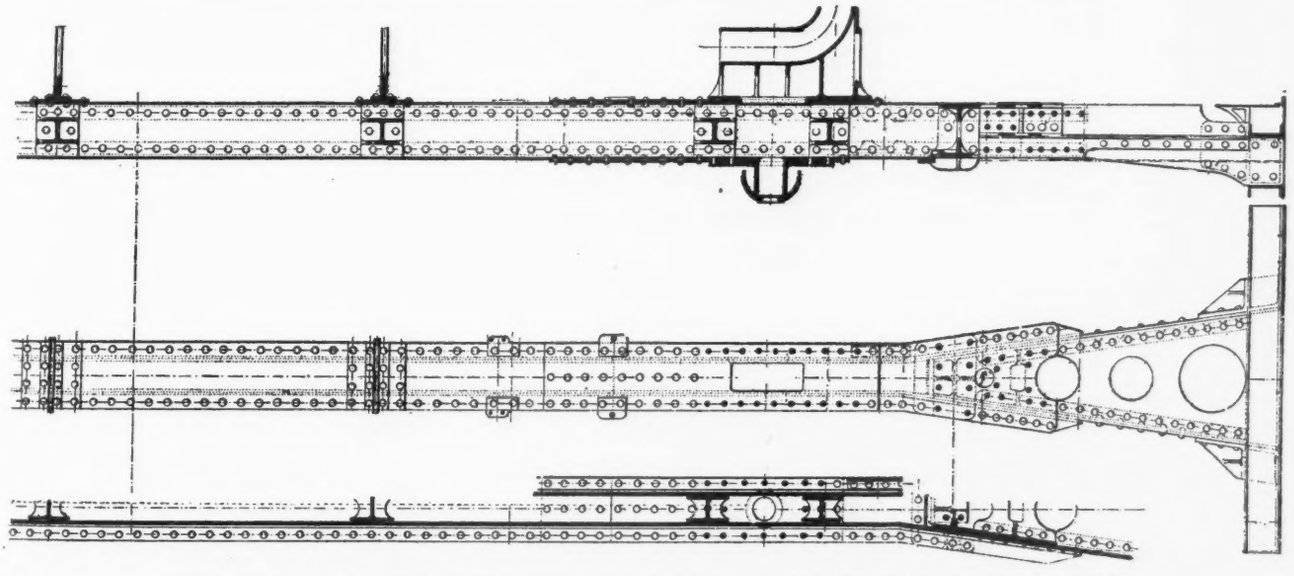
The doubtful advisability of placing two 6-wheeled motors in the same frame led to their division into two perfectly independent groups, so that the engine should be as flexible as possible. The compound system was used, the high-pressure cylinders being placed upon the leading and the low-pressure on the rear trucks. In order to avoid a condensation of the steam in passing from one group to the other, the two sets of cylinders were placed next to each other at the center of the machine.

Steam passes directly from the high to the low-pressure cylinders through an expanding or extending connection. As these cylinders are large and as they are located at the extreme ends of the bogie frames, it was important that there should be little or no overhang, so that a single pair of trailing wheels was placed beyond each one, thus giving the appearance of the two mogul engines already alluded to. These wheels also add to the stability of each bogie truck, which really forms in itself a complete locomotive frame. The tanks and coal spaces provide for about 1,200 gallons of water and 5½ tons of coal.

The engine is so constructed that it consists of three main parts: The two bogies with their engines; the boiler and its connections, and a central frame which is of a peculiar construction. The latter is formed of plates and angles and runs along the center line of the machine, extending from end to end. It carries the boiler and its attachments, and, resting upon the bogies, connects them together. It is flared at each end where the bumpers and draw gears are attached. The illustration shows the boiler resting upon the frame, and the two bogies; the angular displacement of the latter being about the pivotal points. The frame thus rests upon the two pivotal points of the bogies as well as upon four side bearings at the back which are marked G. It is, of course, essential that the forward bogie should have perfect freedom of motion as compared with the one at the back. In order that this may be insured the central frame rests upon the center plate only.



Longitudinal Section of Sixteen-Wheel Compound Bogie Locomotive—Northern Railway of France.



Central Frame of the Sixteen-Wheel Compound Bogie Locomotive—Northern Railway of France.

As these plates have spherical bearing surfaces, the forward truck can thus assume any position whatever relatively to the frame and the other bogie. However, as some limitation to rolling must be imposed two cushioned buffers are inserted to steady the machine.

The four engines are identical in every particular and have valves balanced in accordance with the rules followed by the Northern Ry. The balanced portion of the high-pressure valves are put in communication with the high-pressure exhaust port and that of the low-pressure valves, through an automatic valve, either with the exhaust, when the throttle is opened or with the steam chest when the throttle is closed. This arrangement has the advantage of permitting the throttle to be closed while the engine is in motion as with the ordinary valve, and lessens the resistances that are set up by the ordinary balanced valve at that instant.

The dimensions of the boiler do not vary to any great extent from those of the high-speed express locomotives on the road. The firebox is of copper and the staybolts are all of manganese bronze. The smokebox has a length of about 6 ft. and has a flat netting extending across the whole of its upper portion, set at a height of 11 in. above the axis of the boiler. The exhaust nozzle is circular with a conical head and helical webs. The boiler is bolted at the front end to a steel casting that is, in turn, fastened to the central frame. The shell is fastened to the frame by two supports each formed of two vertical sheets bolted to Ts fastened to the boiler. These act in exactly the same way as the buckle plates that now form the approved method of carrying the boilers on American locomotives. The back end of the boiler rests upon a cast-steel bolster just over the truck pivot.

Owing to the length of the boiler and the method of supporting it, it has been necessary to design a special connection for uniting the shell to the firebox. For this purpose the side sheets of the latter have been extended out over the throat sheets to the back course of the shell, as shown in the engraving.

The dome is very low and contains not only the main throttle but the valve admitting live steam to the low-pressure cylinders. The two are in a single piece and serve to admit steam to both sets of cylinders through special pipes on the outside of the shell.

In case of the rear bogie truck, which has no side play beneath the frames, the steam pipe passes down through the center plate and through two vertical sleeves telescoping into each other. The upper sleeve receives the steam by way of two lateral pipes, and the lower one delivers it to two others that lead it to the cylinders. The joint between the sleeves is metallic and can be tightened when worn.

Steam passes from the high to the low-pressure cylinders through two side pipes, each of which connects the cylinders on one side of the machine, and at the same time forms the receiver. In order to permit of a relative side motion of the two bogies each pipe is fitted with an expansion joint and swinging connections, made with white metal surfaces.

Besides these pipes there is a transverse copper pipe connecting the low-pressure steam chests. The pipes carrying live steam to the low-pressure cylinders enter this pipe, which has a safety valve at each end set to open at a pressure of 92 lbs. per sq. in., a pressure that cannot be exceeded in the low-pressure cylinders. The steam escaping through these valves is led direct to the exhaust from the low-pressure cylinders.

The final exhaust passes through two reinforced rubber pipes to the center forward support of the boiler and thence directly to the exhaust pipe by passages cast in this support. The methods followed in the making of these rubber pipes leads to the expectation of a long life, and they possess the two-fold advantage of requiring only the very simplest of connections, and of being cheaper and lighter than metallic pipes. A similar arrangement will be tried for connecting the high and low-pressure cylinders.

The admission of live steam under a pressure of 92 lbs. per sq. in. to the low-pressure cylinders takes place through a steel pipe attached to the shell of the boiler and extended by a reinforced rubber pipe to the intermediate connection.

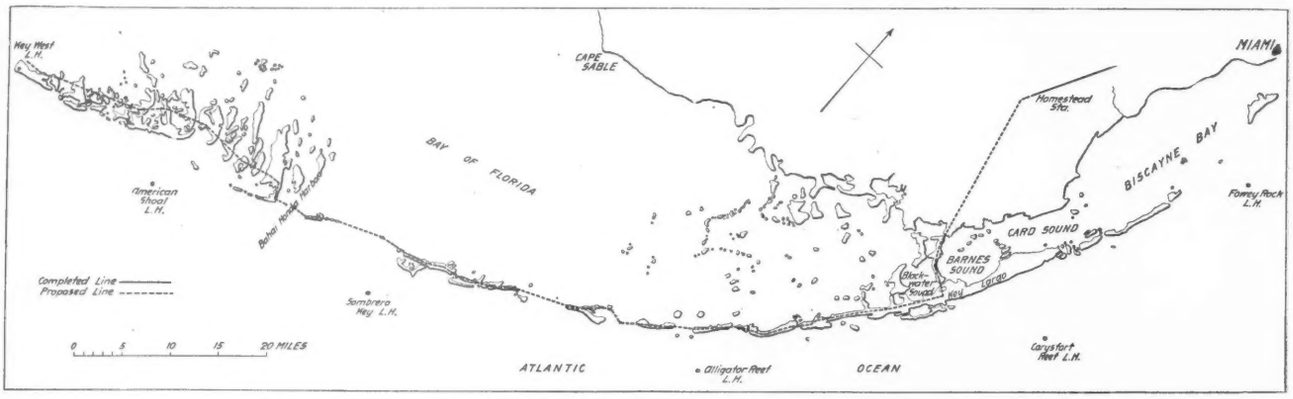
The screw reverse gear is used and is attached to the lifting shafts of both bogies. It can be turned by hand or by an air motor as desired. In the tests that have been made with this machine it has hauled trains of more than 800 metric tons (1,760,000 lbs.) up grades of 1.31 per cent. at speeds of 12.5 miles per hour.

The principal dimensions of these engines are as follows:

Boiler pressure	225 lbs.
Grate area	32.25 sq. ft.
Heating surface, firebox	128.89 "
" " tubes	2,400 "
" " total	2,528.89 "
Tubes—Number 130; type	Serve.
Tubes, outside diameter	2.75 in.
Tubes, length between sheets	15 ft. 7 in.
Boiler, inside diameter of shell	57.32 in.
Cylinders, diameter—H. P. 15.75 in.; L. P.	24.80 "
Piston stroke	26.77 "
Wheels, diameter, driving	57.28 "
Wheels, diameter, truck	33.46 "
Weight of locomotive (empty)	171,600 lbs.
" of locomotive (working order)	224,400 "
" on drivers (supplies exhausted)	158,400 "
Maximum theoretical tractive power (compound)	40,935 "
Maximum theoretical tractive power (simple action)	52,941 "
Tank capacity	1,200 gals.
Coal capacity	5½ tons.

The Florida East Coast Extension to Key West.

The project of Mr. H. M. Flagler, President of the Florida East Coast Railway, to build a railroad over the Florida Keys to Key West, after a number of years of careful estimate and study, has finally reached the stage of actual construction and grading is in progress on some of the northern islands over which the road will run. The present southern seaport terminus of the Florida East Coast is at Miami, from where the Peninsular & Occidental Steamship

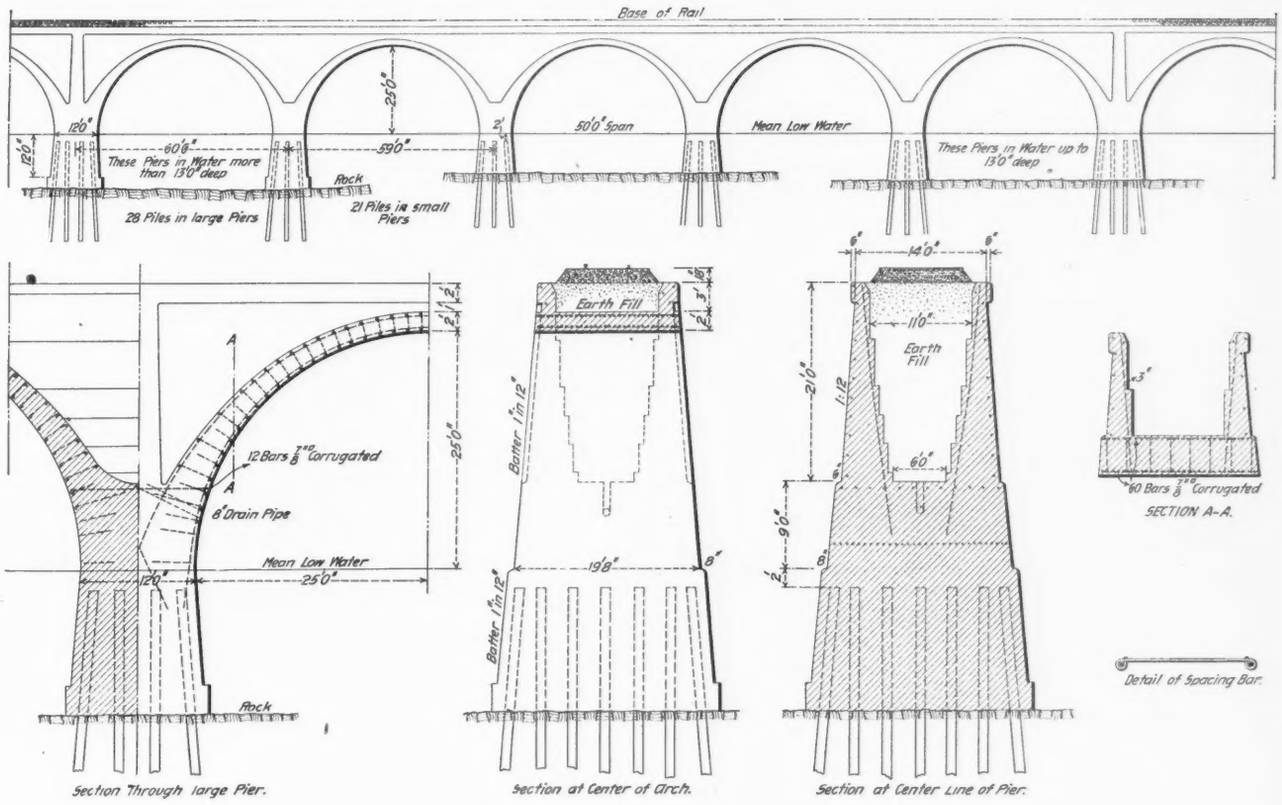


Map of Florida Keys Showing Projected Extension of the Florida East Coast to Key West.

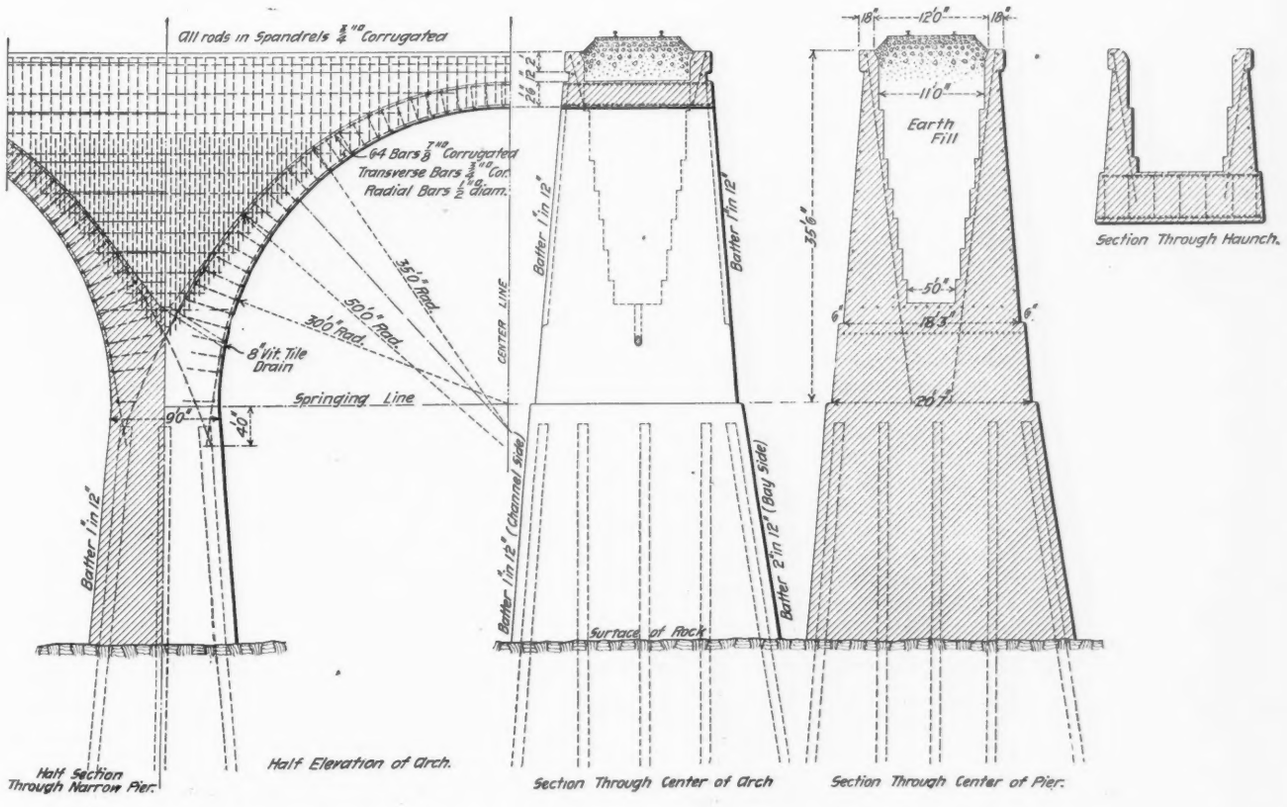
Co.'s boats run to Nassau, Key West and Havana. From Miami to Key West by boat is 165 miles and to Havana 240 miles. Only shallow draught boats can be used in this service, however, because of the shallow water in Miami harbor. Key West has an excellent harbor and is only 90 miles from Havana. Since the war with Spain, Cuba has experienced a tremendous commercial development and as a winter resort it has also become very popular. For these two reasons the new line, which promises to afford much better facilities for communication between Cuba and the mainland, seems to justify the hopes of its promoter as to future traffic.

The accompanying map shows the route of the projected road over the Keys from Homestead, Fla., the present terminus, 28 miles south of Miami, to Key West 126 miles. The long chain of islands extending out from the mainland has been made use of as far as possible, but only about 65 miles will be built on a natural foundation. The remainder of the line is to be built on rock embankments and reinforced concrete arch viaducts. Starting from Homestead the line runs southeast leaving the mainland at the crossing of Jewfish creek and on out onto Key Largo, the longest of the keys. For about 15 miles it runs through the center of this narrow island and then follows the line of the Keys out to Key West. Nearly 30 islands are used for short stretches. Where the intervening water is shallow, a rock embankment will be built, but where the water is deeper and the opening is exposed to storms by breaks in the outer reef, the concrete arch viaduct construction will be used. In the rock embankments there will be a number of 25-ft. openings to allow for the passage of row boats and small craft, and where the line crosses three important channels drawbridges will be put in to pass larger vessels.

The most difficult part of the work will be, of course, the construction of the concrete arch viaducts. There are four of these, aggregating 5.78 miles in length, as follows: From Long Key to



Details of Standard 50-ft. Reinforced Concrete Arch Spans for Key West Extension.



Details of 60-ft. Reinforced Concrete Arch Spans for Key West Extension.

Conch Key 10,500 ft., Knight's Key Channel 7,300 ft., Moser Key form of construction to be used is 50-ft. reinforced concrete circular arch spans and piers, but in some places 60-ft. spans will be used. The water is shallow in most places, from 10 to 30 ft. deep, and the bottom is limestone, but as these waters are frequently disturbed by severe and sudden storms much difficulty is looked for in placing the concrete. A further difficulty lies in the fact that all material, including the broken stone for the concrete, must be shipped by boat from Miami. A good quality of limestone is quarried near Miami and this will be used on most of the work.

The drawings show the details of the arches and the method of reinforcement. On account of the severity of the storms which prevail it will be necessary to firmly anchor the piers to the bottom to prevent shifting out of line. Piles will be sunk into the rock and carried up to within 2 ft. of the springing line of the arches. In the abutment piers which are to be put in at every fifth arch 28 piles are used and in the intermediate piers 21 piles are used. The arches are reinforced with circumferential square corrugated bars near the outside surfaces and with transverse bars which are tied together with ½-in. round radial bars. Earth filling will be put in between the spandrel walls and the ballast laid on top of this above the level of the concrete coping. This will bring the base of rail about 31 feet above the mean low water level. The estimated amount of material to be used in the concrete arches is 206,100 cu. yds. of sand, 286,800 barrels of hydraulic cement, 176,900 cu. yds. of stone and 4,810 tons of steel. A working base will be established at Bahia Honda Harbor, 40 miles north of Key West, where there is from 18 to 28 ft. of water and a good entrance channel. For construction work the following floating equipment will be used:

6 tugs.
1 stern-wheel steamer.
16 barges, 25 ft. x 100 ft.
24 barges, 30 ft. x 100 ft.
12 barges, 20 ft. x 80 ft.
1 sand dredge.
1 earth dredge for filling the concrete viaducts.
8 barges, 40 ft. x 70 ft., with concrete mixers and hoists.
8 pile drivers.
8 towing launches.
1 despatch boat.
4 quarter boats.
100 dinghys.

Were it not for the commercial importance of Key West and the fact that a Government naval base has been established there, Bahia Honda would offer an excellent seaport terminus. It is 40 miles from Key West, but only 20 miles farther from Havana. The outside reef is broken by a wide, deep approach channel from the ocean and deep draught vessels could enter the harbor without danger. Pending the completion of the line from this point to Key West a temporary steamship service will probably be inaugurated to Havana.

At Key West extensive docks and terminals will be built. These will include a dry dock and 10 wharves, each 800 ft long and 100 ft. wide, with basins 200 ft. wide between. The 10 piers will furnish berths for 40 boats 400 ft. long, with a depth of water of from 20 to 30 ft.

Until traffic conditions warrant the establishment of a car ferry, a line of fast passenger and freight steamers will be operated between Key West and Havana, to which all freight will be transferred from the railroad. It is the ultimate intention to put in service a car ferry having a capacity of 30 cars, which will also have accommodations for passengers, and which will make the trip of 90 nautical miles in from 4½ to 5 hours. While the railroad, even after the car ferry is put in service, can hardly expect to compete with the steamers from Havana to New York and New Orleans in heavy through freight traffic, it is expected that a large proportion of the passenger, fast freight and express traffic between Cuba and the United States will be secured.

The construction work is in charge of Mr. J. C. Meredith, Constructing Engineer. It is hoped to have the line completed and in operation in about three years. The estimated cost is between $10,000,000 and $12,000,000. We are indebted to Mr. Flagler for the information and the drawings.

The Austrian State Railroad authorities have issued new regulations providing for a stricter physical examination of employees, especially with regard to their hearing and vision. Locomotive engineers, firemen, trainmen, switchmen, signalmen, track watchmen and car inspectors must have perfect normal vision (6/6 by the Snellen system) in both eyes; station men and other track men are to have the vision indicated by 6/9—not quite perfect; and in both cases without spectacles. Near-sighted men will not be eligible for out-door service. Methods for testing the hearing are prescribed and also the eyes for color-blindness. Tests must be repeated every five years until the age of 45, and after that every three years until 60; then every two years. A considerable degree of far-sightedness is permissible.

Mr. Fink on Federal Rate Legislation.

Mr. Henry Fink, Chairman of the Board of Directors of the Norfolk & Western Railroad, has issued a book on rate regulation, which is noticed on the editorial page of this issue. Mr. Fink's suggestions as to what legislation is necessary and practicable are as follows:

1. The most important legislation that is needed, is an amendment of the Anti-trust Act that will restore to the railroads the right to organize efficient traffic associations for the purpose of establishing and strictly maintaining reasonable rates, and to cooperate with the Interstate Commerce Commission in the enforcement of the laws which prohibit unjust discrimination.

An amendment of the fifth, or anti-pooling section of the Act to Regulate Commerce, so as to permit so-called pooling, is no longer necessary, if it were practicable.

2. If the railroads are unable to deal with the private car lines, Congress should bring these lines under the jurisdiction of the Act to Regulate Commerce and the Elkins Act; and it should also strengthen the present laws by amendments specifically covering all devices for paying rebates, including the allowances made to private sidings, switches, etc.

3. To bring water routes under the jurisdiction of the Commission, as suggested in the President's message, would be a serious legislative mistake. These routes should be left untrammeled by any Government regulation.

4. Good results would follow a reorganization of the Interstate Commerce Commission. The number of members should be increased from five to seven, as provided in the Townsend Bill. But the appointments should be made with a view to the qualifications that are essential in the discharge of their duties, rather than from political considerations. For example—three of the members might be railroad men, three lawyers, and one a business man. Four members, say, two lawyers and two railroad men, should be appointed for life, or during good behavior—the remainder for six years, as under the present law.

5. The Commission should be relieved of the duty of acting as detectives and prosecuting attorneys, and also of the work connected with the safety appliances acts: and its work should be confined to the investigation and decision of cases that come before it.

6. As legislation in this country is responsive to public sentiment, the most important element of success in the effort to regulate rates, is a better understanding by the public of the railroad problem. I would suggest, therefore, that Congress order the reprinting and distribution of a new edition of the Report of the Senate Select Committee of Jan. 18, 1886, together with the forthcoming Report of the Senate Committee on Interstate Commerce, of the Fifty-eighth Congress.

Signal Lenses.

BY A. G. WILSON.

The moulded glass lens used in railroad signal and switch lamps seems to have been a subject attracting little attention, taken for granted and passed by. A lens is to refract the light striking its surface from a given source and project it into the direction from which it is to be observed. Since these lenses have to do duty in all kinds of weather, they should be as efficient as they can be made. The adoption in recent years of lamps burning less oil and the consequent diminished amount of light adds to the importance of this consideration.

Lenses as now applied to railroad lamps are of the Fresnel type, having their corrugated, or stepped surface on the side of the lens next to the source of light. These lenses have three, four and five steps, most of them but three. The reason for the change from three steps to four and five steps is the same as for changing from a plane convex or double convex lens to one having three steps, namely, greater accuracy in design. The improved form gives much less aberration, and the reduction in the thickness of the glass reduces the amount of light absorbed. It is also easier to produce in accurate form.

A plano-convex lens used for this purpose would be very thick and heavy because of being so short in focus compared to its diameter, and would have an aberration so great as to make part of its area of little value.

The lens illustrated in Fig. 1 is of the five-step design, and it "can be filled by a very small source of light." In other words, if we place a small flame in the principal focus of this lens and then take a position on its axis about 100 ft. from its face we shall see every step in the lens illuminated, and therefore projecting the light in the direction from which it is to be observed. Should the lens, when so observed, exhibit wide dark concentric rings, crescents or spots, they are evidence of defect either of design or workmanship.

If, with a source of light as small as, or smaller than the

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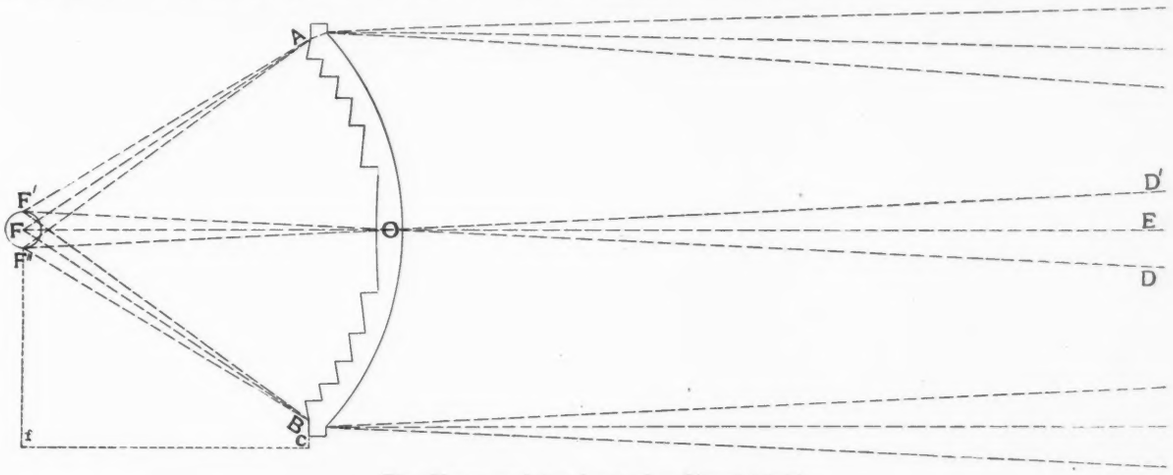
diameter of the flame of the lamp in which the lens is to be used, the illumination of the lens be found perfect, the lens will give satisfactory results in service. The smaller the source of light used in any test of illumination, the more severe will be the test; and a lens giving a good illumination with a small source of light may be assumed to have been accurately designed and skilfully made.

Precise tests ought to be made to determine the actual value of lenses of three, four and five step designs when observed at a distance of half or three-quarters of a mile. Such a test would settle the question of the number of steps. They should be conducted with both a flat wick burner and also with the round burner used in the long-time lamps. After the most suitable form of lens is determined, we have for consideration the most suitable diameter.

In Fig. 1 let us assume, first, that the angle A F B is as large as is desirable, for there is a practical limit to this angle in the design of a lens. Let the lens be so designed that its principal focus falls at, or near, the center of a circular flame, and also let us assume that the lamp is so made that the fount is held in a fixed position and that the distance f c from the center of the flame to the face of the lamp against which the lens rests, conforms closely to the dimension given on the rim of the lens indicating the distance from the plane of the rim to the focus. This being the case, all light from points at a greater distance from the lens than the distance f c will converge to points on the axes after passing through the lens. These points of convergence become farther from the lens and approach infinity as the point from which the light emanates approaches the point F, when, if we disregard aberration, the light passing through the lens from point F leaves the face of the lens in parallel rays. Light from any point in the focal plane as at points F′ or F″ will be parallel to the secondary axes F′D and F″D′. Therefore, as long as the source of light has dimensions, we shall still have some light converging along the axes and forming a pencil, which when it strikes the eye of the observer, conveys not only the impression of light, but also of magnitude, because the rays are converging. Light from a source less than the distance f c will diverge after passing through the lens and spread over a considerable area, giving a wider range of vision for an observer.



The Flame and the Lens of a Signal Light.

A question frequently asked is as to the angle within which an observer may stand and be able to see the light clearly. Since the lens gives the maximum effect with its principal focus at the center of the flame, we can say with perfect safety that the diameter of the field of light at any given distance from the lens depends on two factors, the distance F O and the diameter of the light, as follows: The horizontal diameter covered by the projected light at the distance O E from the lens will be equal to $\frac{O\ E}{F\ O} \times$ diameter of flame. Therefore, if at any required distance O E the light does not cover sufficient area and is more brilliant than is needed, we can substitute a lens of smaller diameter in which the angle A F B is the same as before and the distance O F will be shorter. The angle A F B being the same as before, we shall get the same amount of light that we did before, but $\frac{O\ E}{F\ O} \times$ diameter of flame will be greater, therefore the light will be spread over a greater area than before, but no portion of this area will be as brilliantly illuminated as before.

Suppose, on the other hand, that in the case first considered the light is spread over a greater area than is desired and that we would prefer it more brilliant, we take a lens whose diameter is greater, keeping the angle A F B the same as before, and have the distance F O greater; and $\frac{O\ E}{F\ O} \times$ diameter of flame will be less than before, therefore the area will be more brilliantly illuminated.

If we take two cases in which the quotients of $\frac{O\ E}{F\ O} \times$ diameter of flame are 9 and 10 respectively, the light striking the eye of the observer will be 24 per cent. greater in the former case than the latter. If the area of illumination obtained by this method is sufficiently great, and the illumination more intense than is desired, we may substitute a lens of smaller diameter but whose focal distance F O is the same, and obtain the desired results. The lens of larger diameter will give to the observer the impression that the source of light is greater because the angle of the pencil of light entering the eye is greater. However, the difference between lenses of equally good design of 4 in. diameter, 4⅛ in. diameter, and $4^{3}/_{16}$ in. diameter would hardly be distinguishable; nor between 5 in. diameter and 5⅜ in.; or 6 in. and 6⅜ in.; or 8 in. and 8⅜ in. The lenses of commerce do not conform strictly to the theoretical angle A F B, but they come so close to it that there is little, if any, practical difference in them.

A number of railroads—few or many—having like interest, that is an interest in uniformity, could do much good by deciding, once for all, the most suitable diameter and focus of lens to use with a given size of flame. Then, by proper inspection and care to see that the lamps and lenses conform to these requirements, uniformity would be accomplished. Until recent years there has been a great discrepancy in pressed glass, but it is now possible to obtain lenses which could hardly be improved except by grinding.

Fixing the diameter of the lens as above noted, makes it a standard diameter and focus for all lamps. The use of anything larger than is actually needed is a useless expense. Once the size of lens is fixed, the size of glass for the semaphore is fixed, and uniformity can then be secured, giving the desired results at minimum expense.

Railroad Cases Decided in September.

The following abstracts cover cases decided by the United States Supreme and Federal Courts in August:

Railroad Aid Bonds.—A provision of the Nebraska constitution makes registration of railroad aid bonds by the State Auditor a condition of their validity, without which they are unenforceable though authorized by the voters and issued by the proper authorities. In a recent case it developed that the auditor refused registration on the ground that the proposition to issue the bonds was submitted in the alternative; that is, they were to be issued to either one of two roads which first complied with the conditions of the proposition voted upon, and, consequently, in his view there was uncertainty as to the identity of donee of the bonds. The Supreme Court of the state upheld the auditor's action, and the Federal Court in this case refused a hoider of the bonds any relief on the ground that having waited more than 20 years to invoke the aid of the court he had lost any right open to him had he acted with diligence. Frank vs. Butler County, Nebraska, 139 Federal Rep. 119.

Limited Liability—Bills of Lading.—A shipper of goods under a contract limiting the liability of the carrier for loss by fire based on a reduced rate, who did not request the carrier to furnish a rate without such a condition, cannot, after a loss has occurred, disregard the condition and recover the value of the goods lost on the ground that he did not believe that the rate would have been conceded if he had asked for it. Arthur vs. Texas & Pacific Railway Co., 139 Federal Rep. 127.

Railroad Bridges Over Navigable Waters.—The lawfulness of

the Pittsburg, Fort Wayne & Chicago bridge over the Allegheny river is the subject of a recent Federal Court decision. The bridge was built under a State legislative grant which antedated the congressional act assuming control of navigable waters. The court holds that the authorization was sufficient and was not affected by the later Federal statute, and that the original grant being sufficient, carried with it the right to reconstruct the bridge when necessary without asking the consent of Congress. This conclusion was necessary to the decision of a case where a steamboat was injured by collision with piles used in the reconstruction of the bridge, the vessel owners contending that the bridge was an illegal structure. Rogers & Co. vs. Pittsburg, Fort Wayne & Chicago Railway Co., 139 Federal Rep. 7.

Special Stock Trains.—The well-grounded rule of courts that a written contract cannot be varied by other testimony is applied to a shipping contract, and it is concluded that where the contract for transportation of cattle is silent as to the time and manner of transportation, that it can be shown that it was customary to furnish an independent train for the transportation of stock amounting to ten cars or upward when demanded. In other words, the case stated did not violate the principle. Northern Pacific Railway Co. vs. Kempton, 138 Federal Rep. 992.

Railroad Shop Tools.

MILLING MACHINES.
(*Continued.*)

The accompanying illustration, Fig. 1, shows a 32-in. x 26-in. x 10-ft. planer-type milling machine made by the Becker-Brainard Milling Machine Co., Hyde Park, Mass. This machine is of a new design and is of heavy construction. The spindle is made of hammered crucible steel, 5 in. in diameter. It has a threaded nose and runs in self-centering bronze boxes, which are fitted with nut and

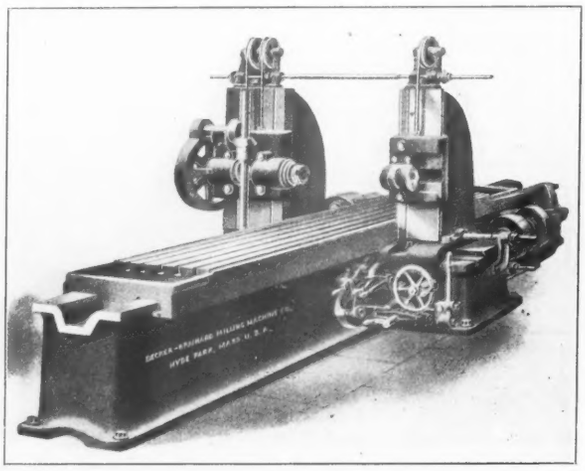


Fig. 1—Becker-Brainard Planer-Type Milling Machine.

check nut to compensate for wear. The spindle carrier is heavy and is held firmly to the upright by long gibs. It is elevated by a screw with adjustable dials graduated to thousandths of an inch and has counterbalance for ease of operation. The spindle is driven by a 5-in. belt on a five-step cone, the largest step of which is 23 in. in diameter and the smallest 13 in. in diameter, giving gear ratios of 13½ and 27 to 1, thereby allowing 20 changes of speed. By means of a hand lever and quick change gearing, the speed is easily adjusted. The table is made with five longitudinal T slots and is provided with an oil channel its full length and at each end. It travels on flat ways securely gibbed and has a quick return operated by power from a separate countershaft. It can also be moved by the usual hand wheel. The feed of the table is directly operated through gearing from the main driving cone, giving a range of feed through eight changes from $^{3}/_{64}$ in. to ⅜ in. These changes of feed can be made by a lever, without stopping the machine. The head may be adjusted from either side of the machine, so that it is not necessary to take the cutters off the arbor in order to change their position in relation to the work. The bed is extra deep, extending to the floor and making a solid foundation. It is securely braced by heavy cross girders which are evenly spaced throughout the entire length. The bed can be made any length desired. The principal dimensions of the machine are as follows: Working surface of platen, 120 in. x 26 in.; length of bed, 168 in.; longitudinal feed, automatic in both directions, 120 in.; maximum distance from center of spindle to table, 28 in.; minimum distance from center of spindle to table, 2 in.; greatest distance from end of spindle to center of table, 16⅜ in.; shortest distance from end of spindle to center of table, 6¾ in.; greatest distance from end of spindle to tail stock spindle, 37 in.; least distance from end of spindle to tail stock spindle, 17 in.; net weight, 25,000 lbs.

These machines can be fitted with motor drive when desired, in which case the motors are conveniently located in the rear of the machine and out of the way of the operator. They are secured

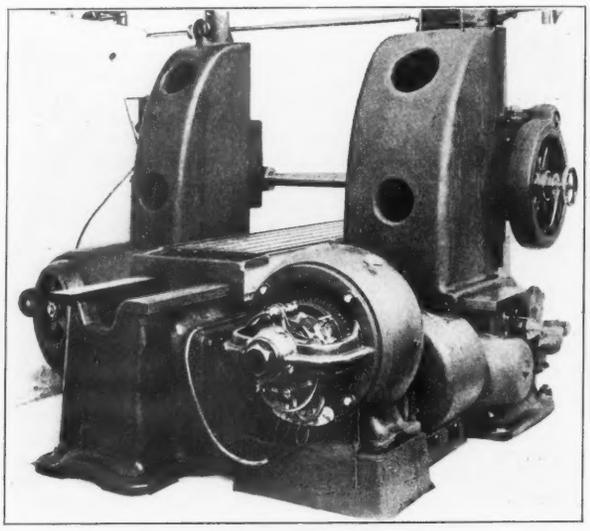


Fig. 2—Becker-Brainard Heavy Planer Type-Milling Machine With Motor Attached.

to a special base by means of four bolts, as shown in Fig. 2, and the controller is then placed in a convenient position on the outside of one of the uprights.

Fig. 3 shows a horizontal spindle milling machine made by the Beaman & Smith Co., Providence, R. I. This machine is used to a large extent in milling keyways in locomotive axles. It has but one spindle, which is carried in a vertically adjustable cross-head. The spindle is also provided with horizontal adjustment and a tapered hole for holding cutter shanks and arbors. The table is provided with automatic feed its full length, and the working surface of the table is surrounded by a trough to collect the lubricant. From the trough the lubricant runs into a tank and is returned to the cutters by a pump. The table has a working surface of 14 in. wide by 8 ft. long. The spindle is 2⅜ in. in diameter and has a horizontal adjustment of 1 in. The maximum capacity of this machine between uprights is 19 in. The maximum distance from the center of the spindle to the top of the table is 20 in. and the minimum distance is 3 in. Cutters up to 8½ in. in diameter can be used. The power is transmitted through gearing having a ratio of 6:1. The cone pulley has three steps ranging from 14 in. to 20 in. in diameter, and is driven by a 3½-in. belt. The countershaft has one tight and one loose pulley 18 in. in diameter for a 4½ in. belt, and it should run at 200 r.p.m. The machine complete weighs about 10,000 lbs.

(*To be continued.*)

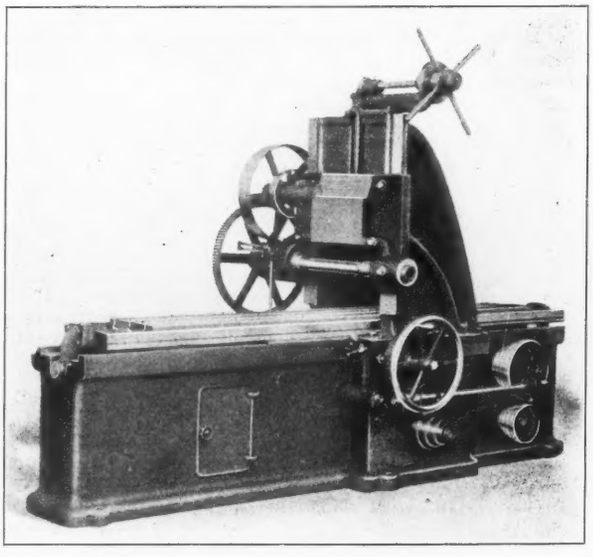
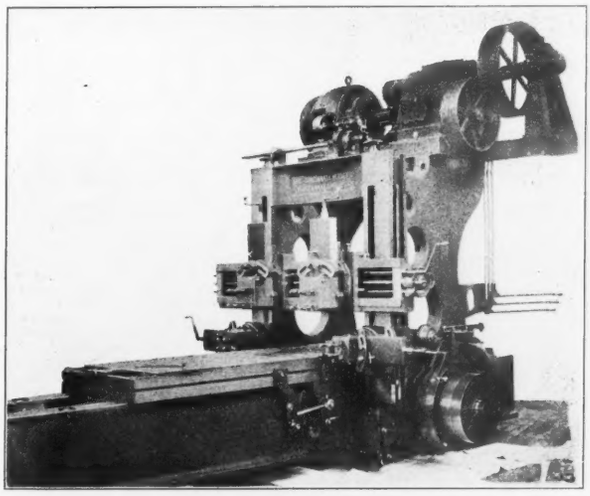


Fig. 3—The Beaman & Smith Horizontal Spindle Milling Machine.

A New 48-in. Variable-Speed Motor Driven Planer.

The accompanying illustration shows a 48-in. variable speed motor-driven planer made by the Cincinnati Planer Co., Cincinnati, Ohio. This machine is of an entirely new design throughout and contains several noteworthy features. It is driven by a constant speed motor, and by means of a speed box is arranged to furnish six cutting speeds ranging from 22 ft. to 51 ft. per minute, with a constant return speed of 80 ft. per minute. The changes in cutting speeds can be made either while the machine is in operation or standing idle by means of the three levers shown at the right in the photograph. The gears in the speed box are of steel and are completely encased in a cast-iron box, which holds several gallons of oil. This oil is also used for lubricating the bearings; the gears carry it to the top of the box, and it passes into the various oil chambers which have openings at the bottom, allowing it to drain back after encircling the shafts, and thus keeping a constant flow of oil on all the revolving parts and reducing the wear and noise to a minimum. The beds are made of extra length, so that there is very little overhang of the table when planing at full stroke. The V's are also made much wider than usual. The tables are deep, and have a set of dogs and a complete shifting mechanism on each side. The housings are carried down to the floor, and in addition to the usual bolts and dowel pins are secured to the bed by a long tongue and groove. The cross rail has a very large bearing on the housings, and is strengthened by an arch-shaped brace at the back. The heads are of a new shape, the end of the tool block and slide being made round to avoid projecting corners on angular work. They are provided with taper gibs and the slides are hung on ball bearings. An automatic tool lifting device is also furnished, which is not shown in the illustration. The side heads are controlled by handles which travel up and down with them, and are therefore always convenient to



The Cincinnati 48-in. Variable-Speed Motor Driven Planer.

the operator. These side heads are similar to those used on the cross rail, are very rigid, and may be run below the level of the top of the table when not in use. The cross rail is raised and lowered by means of the patent power lifting device, which was described in detail some time ago. The driving pulleys have been increased in width, and are furnished with oil reservoirs, which insure their being properly oiled with a minimum amount of attention. The pulley shaft, which is the only high-speed shaft in the machine, is made ring oiling and has Lumen bronze bearings.

The Wabash as a Competitor of the Missouri Pacific.

In reply to a published statement that if the Wabash should cease to be a Gould road, it would get no more traffic out of Chicago than it is now getting and would lose a large amount of business that now comes to it at Kansas City and St. Louis, Mr. Ramsey has written a letter in which he says: "The Missouri Pacific gives practically nothing to the Wabash at Kansas City; on the contrary, the Missouri Pacific is the sharpest competitor the Wabash has between St. Louis, Kansas City and Omaha; and it has a great advantage over the other competitors of the Wabash by having its traffic head also in control of Wabash traffic. The Rock Island, the Santa Fe, the Union Pacific and the Kansas City Southern were all formerly the close allies of the Wabash at Kansas City, for St. Louis and other traffic, which traffic and friendly relations the Wabash has lost, since it is supposed by these lines to be dominated by Missouri Pacific interests. The Frisco; Missouri, Kansas & Texas and Rock Island all reach St. Louis, and whereas the Wabash formerly received a goodly portion of the traffic of these lines for eastern points at St. Louis, they now favor the lines competitive with the Wabash, because the other 'Gould lines' west of St. Louis are competitive with them. The Missouri Pacific and Iron Mountain can deliver traffic to the Wabash only at St. Louis, and if they delivered all their traffic at that point to the Wabash for eastern points, it would help somewhat to make good the loss from other lines; but the Missouri Pacific works quite closely with the other strong eastern lines—the Big Four, Vandalia, Baltimore & Ohio, and others—in order that the Missouri Pacific may get some of these lines' westbound traffic west. The Wabash is also a heavy loser in traffic at Chicago and Omaha on account of being a 'Gould line.' Every large western system and Pacific coast line reaches Chicago, and naturally they desire to bring their traffic to that point for the 'long haul.' The Missouri Pacific and Iron Mountain do not reach Chicago. The Wabash has a good line eastward from Chicago and, naturally, like all other Chicago-New York lines, looks to the lines west of Chicago for traffic—to the Santa Fe, Rock Island, St. Paul, Burlington, Union Pacific, Northern Pacific and Great Northern lines, etc.—but as all these lines are in direct, or, at least, indirect competition with the other Gould lines west, they 'throw down' the Wabash and turn to its competitors east, who are not in competition with them in the west. The traffic statistics of the Wabash will show, since the placing of all the 'Gould lines' under one traffic head, a great loss to the Wabash from other sources (and the records will not show all of it), and this loss would have been greater if I had not prevented the entire control of traffic passing from my hands. This was really the cause of the first difference between Mr. Gould and myself, and Mr. Gould not only admitted to me some four months ago that I was right in my views, and that the results during the two years had 'justified your (my) position,' but the traffic department of the Wabash has practically been divorced from the other Gould lines by Mr. Gould's own action in the last three months. When I declined to let Wabash cars be taken from our good paying local traffic to go into this joint Wabash-Missouri Pacific traffic, when the Wabash was losing money on it, I was advised by Mr. Bird that he was acting on Mr. Gould's orders."

Mr. Ramsey on October 2 filed a suit for an injunction in the Circuit Court at St. Louis, Mo., against the St. Louis, Iron Mountain & Southern and the Wabash railroads and George J. Gould and others. He asked the court to grant him an injunction restraining the defendants from holding the proposed annual meeting at Toledo, October 10, on the ground that one result of this meeting would be to stifle competition in traffic between the Wabash and Missouri Pacific, between St. Louis and Kansas City. The ownership of parallel and competing railroads by the same interests is forbidden by the constitution of Missouri. (See also editorial columns.)

The Twenty-Fourth Annual Meeting of the American Street Railway Association and Affiliated Associations.

The twenty-fourth annual meeting of the American Street Railway Association and its affiliated associations, which include the American Railway Mechanical and Electrical Association, the Street Railway Accountants' Association of America and the American Association of Street Railway Claim Agents, was held in the Philadelphia Museum, Philadelphia, Pa., Sept. 25 to 30. The third annual meeting of the American Railway Mechanical and Electrical Association was held Sept. 25 and 26. President C. F. Baker, Superintendent of Motive Power and Machinery, Boston Elevated Railroad, called the meeting to order and introduced Hon. John Weaver, Mayor of Philadelphia, who made a brief address in which he welcomed the Association to the city. Following Mayor Weaver, President Caryl Ely, of the American Street Railway Association, spoke to the members in regard to the reorganization and betterment of the Street Railway Association, and also referred to the interesting and well arranged exhibits displayed by the various members of the American Street Railway Manufacturers' Association in the exhibition room of the museum. President Baker then made his annual address, after which the following papers and reports were read: "Power Distribution," by C. H. Hile, Superintendent of Wires, Boston Elevated Railway Company, Boston, Mass.; "The Power Station Load Factor as a Factor in the Cost of Operation," by L. P. Crecelius, Chief Electrician, The United Railways Company, St. Louis, Mo.; report of the committee on "Controlling Apparatus," by J. S. Doyle, Chairman, Master Mechanic, Interborough Rapid Transit Co., New York, N. Y.; report of the Committee on Way Matters, "Welding of Rail Joints," Chairman, F. G. Simmons, Superintendent of Construction and Maintenance of Way, The Milwaukee Electric Railway & Light Company, Milwaukee, Wis.; report of the Committee on "Maintenance and Inspection of Electrical Equipment," Chairman, William Pestell, New York, N. Y.; "The Power House," Fred N. Bushnell, Chief Engineer, The Rhode Island Company, Providence, R. I.; "The Track Brake," by F. F. Bodler, Master Mechanic, The United Railroads of San Francisco, San Francisco, Cal.

The American Street Railway Association's twenty-fourth an-

nual meeting was held Sept. 27 to 28. The meeting was opened with an address by President Ely. The Secretary and Treasurer, Mr. T. C. Pennington, reported a total membership of 206, and stated that the cash on hand up to Sept. 15, 1905, was $6,732.20. Mr. Pennington concluded his report by stating that probably this would be the last year that he would serve the Association as its Secretary inasmuch as the Executive Committee desired a technical man and a man who could devote his entire time to the office. At the conclusion of the Secretary's report the following papers were read: "Notes on the Design of Large Gas Engines with Special Reference to Railway Work," Arthur West, Westinghouse Machine Co.; "The Application of Gas Power to Electric Railway Work," J. R. Bibbins, Westinghouse Machine Co.; "Single-Phase Railway System," Chas. F. Scott, Westinghouse Electric & Manufacturing Co.; "Electric Railway Equipment," W. B. Potter, General Electric Company; address on Organization, Henry L. Doherty, National Electric Light Association; remarks on Diesel Engine, Mr. E. D. Meier, American Diesel Engine Company.

The annual convention of the Street Railway Accountants' Association of America was held Sept. 28 to 30, inclusive. A number of interesting papers were read, a partial list of which follows: "The Cost of Carrying a Passenger," C. L. S. Tingley, Second Vice-President, American Railways Company, Philadelphia, Pa.; "Interurban Fare Collections," Irwin Fullerton, Auditor, Detroit United Railway, Detroit, Mich.; "Interurban Ticket Accounting," J. H. Pardee, General Manager, Rochester & Eastern Rapid Railway, Canandaigua, N. Y.; "Accounting with Four Departments," H. M. Beardsley, Secretary and Treasurer, Elmira Water, Light and Railway Company, Elmira, N. Y.

An important feature of this year's American Street Railway Convention was the adoption of the new constitution and by-laws by practically a unanimous vote. The name of the Association hereafter will be the "American Street and Interurban Railway Association," and its headquarters will be in the City of New York. The Association will do all in its power to promote the welfare of its affiliated associations, or other associations organized with its approval to investigate technical matters connected with street and interurban railway construction and operation.

Among the exhibits at the convention were the following:

Adams, Westlake & Company, Chicago.—Signal lamps, lanterns, headlights and car trimmings.

Allis-Chalmers Co., Milwaukee.—Reception room and photographs of various departments of its works.

American Brake Shoe & Foundry Co., New York.—Brake shoes for electric railway and steam road service.

American Car & Foundry Co., New York.—One of 134 all-steel electric passenger cars made for the Long Island Railroad. Total weight of car 67,600 lbs.

American Locomotive Sander Co., Philadelphia and Chicago.—Pneumatic track sanders for both steam and electric roads.

American Railway Supply Co., New York.—Merchandise checks, conductors' and trainmen's badges, buttons, metal plates, etc.

Atlas Railway Supply Co., Chicago.—Complete line of "Atlas" braces, tie plates, step joints, insulated joints and straight track joints.

Baldwin Locomotive Works, Philadelphia, Pa.—Electric trucks for heavy street car service; also an electric truck built for the South Side Elevated Railroad Co., Chicago. Track exhibit of an electric yard engine built for the Yale & Towne Mfg. Co.

Baltimore Railway Specialty Co., Baltimore, Md.—Ball-bearing center and side bearings.

J. G. Brill Company, Philadelphia, Pa.—One of 200 electric street cars built for the Chicago City Railway Company; Brill's patent semi-convertible street car built for the United Railways & Electric Co., of Baltimore; and a Brill's patent convertible "All-year round Car;" also a No. 23 freight car truck and a No. 27-E 2 truck with solid forged frames; also a steel street car for the New York City Railway Co.

Buda Foundry & Mfg. Co., Chicago.—Paulus track drill with special spindel and chuck fitted with a "Rich" high-speed bit; Buda track drills, switch-stands, car replacers, ratchet, friction and ball-bearing jacks, track signs, switch clips, switch rods, rail braces, insulated rods and stub-switch fixtures.

Bullard Automatic Wrench Co., Providence, R. I.—The Bullard automatic pipe and nut wrench.

Chicago Pneumatic Tool Company, Chicago.—Duntley electric drills, Keller & Boyer pneumatic hammers, "Little Giant" and Boyer piston drills, Keller rotary drills, pipe-bending machines, and air forges.

Consolidated Car Heating Co., New York.—Direct steam and hot water car heating systems.

Continuous Rail Joint Co., of America, Newark, N. J.—Samples of rail joints.

The Curtain Supply Co., Chicago and New York.—Curtains for both open and closed cars, fitted with Acme, Climax, Forsyth, Burrowes, Keeler pinch-handled and eccentric, and a new type of open car ring fixtures.

Dilworth, Porter & Co., Ltd., Pittsburg, Pa.—Descriptive matter and samples of "Goldie's" claw and "Perfect" tie plates; also the Glendon flange tie plate and samples of spikes.

The Joseph Dixon Crucible Co., Jersey City, N. J.—Graphite lubricants, lead pencils, graphite paint, etc.

Dressel Railway Lamp Works, New York.—Signal lamps, long-burning founts and semaphore lamps—all steel.

The Duff Mfg. Co., Pittsburg, Pa.—Barrett motor armature lifts (two types); Barrett jacks and the Duff roller-bearing screw jacks.

The O. M. Edwards Co., Syracuse, N. Y.—Car window and curtain fixtures; also platform trap doors.

The Electric Storage Battery Co., Philadelphia, Pa.—Chloride accumulators, including one of the type of cells installed at the Hammel substation for the electrification of the Long Island Railroad; also a New York Central type of cell which will be used in the substations, and which will have a total capacity of 20,000 h. p. per hr. A new type of regulating booster with the "Entz" carbon regulator; a pilot cell fitted with a displacing tank, an automatic cell filler, signaling hydrometer, recording hydrometer and compensating hydrometer; also signal batteries and switchboards.

The Electro-Dynamic Co., Bayonne, N. J.—A 5-h. p. 550-volt "Inter-Pole" reversible variable speed motor, with a speed variation of 350 r. p. m. to 1,400 r. p. m., belt connected to a 5-h. p. "Inter-Pole" generator acting as load.

Franklyn Railway Supply Co., Franklyn, Pa.—The Western water-jacket car heater.

Galena Signal Oil Co., New York.—Samples of oil for electric railway use; also large reception room.

General Electric Co., Schenectady, N. Y.—Alternating and direct-current car equipment, as applied to four a.-c. and d.-c. 75-h. p. railway motors mounted on two of Brill's No. 27-E-2 trucks fitted with G. E. Co.'s air brakes; type "M" automatic train control equipment; two G. E. 69,200 h. p. railway motors, which have been in service on the New York Subway for about one year, one of them having run 45,248 miles, and the other 53,005 miles; a 500-k. w. Curtis steam turbine and two 30-ampere mercury arc rectifiers.

Goldschmidt Thermit Co., New York.—Samples of coils welded by the Goldschmidt Thermit process; also demonstrations of rail-welding.

Gould Storage Battery Company, New York.—Several types of stationary and portable battery plates; also an "S" 49 element in an "S" 49 lead-lined tank; also photographic views of a number of recent installations.

Indianapolis Switch & Frog Co., Springfield, Ohio.—Descriptive matter only.

Johns-Manville Co., H. W., New York.—All types of fuses; asbestos boiler and pipe coverings and asbestos packing; also "Transite" and "Electrobestos;" electric car heaters, third-rail insulators, underground fuse and service-boxes for lighting systems, and a full line of trolley material.

Kalamazoo Railway Supply Company, Kalamazoo, Mich.—The "Root" track scraper, and Kalamazoo track jacks and gages.

David Lupton's Sons Co., Philadelphia, Pa.—Lupton's fireproof automatic windows for buildings.

Manning, Maxwell & Moore, New York.—Injectors, safety valves, Hancock inspirators, valves, gages, indicators, etc.

Miller Anchor Co., Norwalk, Ohio.—The Miller anchor for railroad wrecking purposes.

The National Brake Co., Buffalo, N. Y.—The "Peacock" hand brake for both steam and electric equipment.

National Lock Washer Co., Newark, N. J.—Samples of the "National" lock washers; also several types of window and curtain fixtures.

Oliver Machine Co., Grand Rapids, Mich.—Wood-working and pattern shop machinery.

The Pantasote Company, New York and Chicago.—Pantasote curtain materials.

Pennsylvania Steel Co., Philadelphia, Pa.—Spring rail frog, split switch, switch point-locking device, reinforced split switch with adjustable connecting bar; "New Century" adjustable and non-adjustable switch stands and the "New Era" switch stand.

Philadelphia Rapid Transit Co., Philadelphia, Pa.—Showing the various stages of the construction of its standard track work as used on heavily traveled streets; also special trolley poles made by the Standard Tube Co., of Pittsburg.

Pressed Steel Car Company, Pittsburg, Pa.—An all-steel electric surface car built for the New York City Railway Co.

The Railway Journal Lubricating Co., Chicago.—The Economy lubricator and dust guard.

Standard Railway Track Appliance Co., Kalamazoo, Mich. (successors to Merrill-Stevens Mfg. Co.).—Track and car jacks, cattle guards and the "Cook" collapsible self-feed rail drill.

Standard Steel Works, Philadelphia, Pa.—Cast-steel wheels and gear complete as furnished to the Interborough Rapid Transit Co., New York; also mounted rolled steel electric truck wheels.

The T. H. Smyington Company, Baltimore, Md.—Journal boxes.

The A. G. Stiles Anti-Friction Metal Co., New Haven, Conn.—The "Stiles" patent car journal bearings and anti-friction metals.

The Sherwin-Williams Co., Cleveland, Ohio.—Samples of paints and varnishes; also a large display of sample boards demonstrating the use of surfacers, colors and varnishes.

John Simmons Co., New York.—Steam separators, iron pipes, and pipe fittings.

The Standard Paint Co., New York.—Ruberoid roofings, Ruberoid motor cloth, P. & B. insulation, P. & B. electrical compounds, S. P. C. flexible iron paint and "Flexite" metal preservative paints and P. & B. insulating tape.

Underwood Typewriter Co., New York.—Various types of the Underwood visible typewriting machines.

The U. S. Metallic Packing Co., Philadelphia and Chicago.—Metallic piston rod and valve stem packing for all services, including both steam and gas engines.

The Weber Railway Joint Mfg. Co., New York.—Full-sized samples of the Weber rail joint for both steam and street railroad service.

The Westinghouse Traction Brake Co., Wilmerding, Pa.—A new automatic air brake equipment for handling a motor car and trailer, combining the advantages of automatic application and straight air-brake release. Straight air-brake equipment with automatic application on emergency and a combined straight and automatic air brake equipment for electric locomotives.

Westinghouse Electric Co., Pittsburg, Pa.—The Westinghouse multiple unit system of street car control, showing a complete car equipment operating 2 200-h. p. motors. M. P. lightning arrester with apparatus for subjecting it to static bombardment with either a. c. or d. c. line voltage, simultaneously impressed over the terminals.

Yale & Towne, New York.—Chain hoists and blocks, including duplex, triplex and electric, ranging in capacity from 1 to 20 tons.

C. G. W. Station Agents' Meeting.

A committee of employees of the Chicago Great Western has started a magazine called the *Maple Leaf Bulletin*, which, it is hoped, will find sufficient favor to become a permanent medium of communication between the men in different departments and on different divisions of the company's lines; and the first article in the first number is an abstract of the discussion which took place at a meeting of about a hundred officers and agents at Oelwein, August 6. We note some of the points brought out, Mr. C. T. Banks, Freight Claim Agent, being the principal speaker.

Of all the loss and damage claims presented, 44 per cent. are for less than $5; and 19 per cent. between five and ten dollars. This indicates that it is a great number of little things which makes the most trouble; the careless handling of packages; dropping them from cars to platforms; carrying perishable freight past its destination, etc. Of over-charge claims 67 per cent. are under $10; being due largely to careless weighing and improper classification. The annoyance caused to consignees in these cases may be more costly to the road than the money loss of settling the claims. Mr. Banks impressed upon the agents the necessity of promptly reporting errors and losses, especially damage to freight caused by improper loading or putting it into dirty cars. Freight carried past its destination should always be reported, even if it is at once returned. In five months Mr. Banks had paid many hundreds of dollars for losses on account of damage by snow and water getting into cars, largely through the end doors. He asked the agents if it would not be practicable to have fewer and smaller end doors.

Mr. Banks called attention to delays, sometimes resulting in claims, which had been caused by holding freight at junctions waiting for the connecting line to furnish a car. Another costly error was that of agents in failing to check shippers' errors in marking

tubs of butter. If a tub of creamery butter goes wrong and has to be sold without its trade-mark, it brings about five cents less a pound.

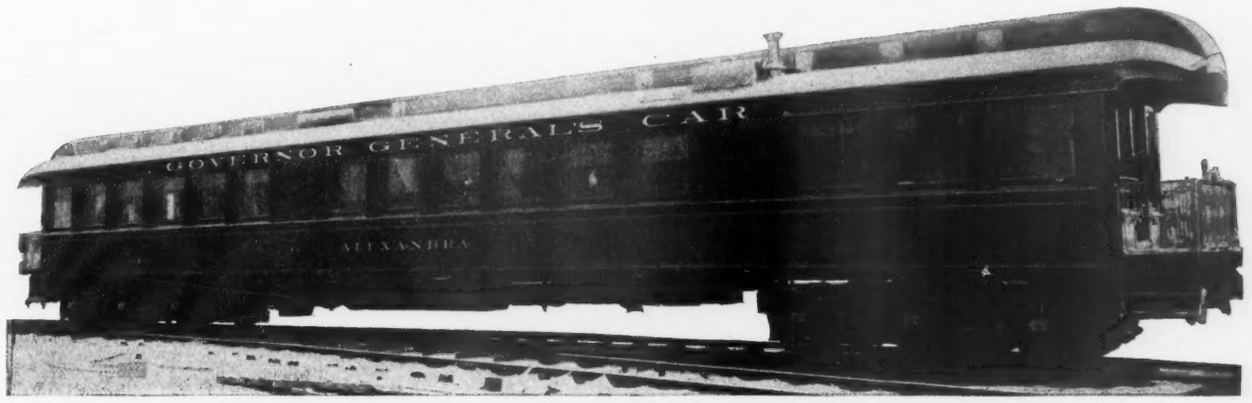
A New Car for the Canadian Government.

The accompanying illustration shows the car "Alexandra" which was recently delivered by Messrs. Rhodes, Curry & Co., Ltd., Amherst, N. S., to the Canadian Government. The car is for the use of the Governor General, and it is stated that the construction and equipping of it by the makers was more a matter of pride and patriotism than a money consideration. The design and specifications were furnished by S. King, formerly Master Car Builder of the Government railroads. The cross section shows that evidently the tunnel clearances in the United States and Mexico were considered in designing the general outline. The principal dimensions are as follows:

Length over platform	79 ft.	4½ in.
Length over end sills	72 "	0 "
Width over side sills	9 "	10 "
End sill to center of bolster	8 "	0 "
Bolster centers	5 "	0 "
Needle beam centers	10 "	6 "
Transom centers	30 "	8 "
Wheel base	10 "	6 "
Total wheel base	66 "	6 "

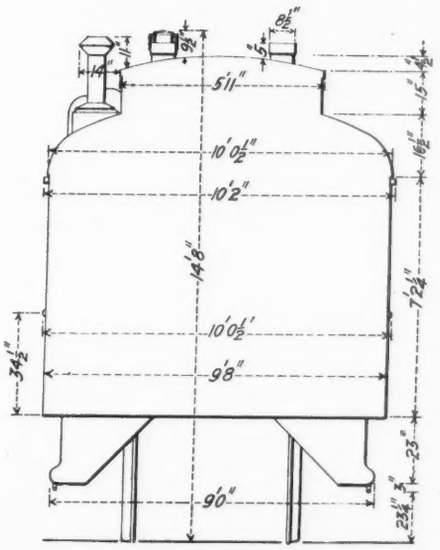
The special equipment includes: The Standard Steel Company's platforms; Westinghouse high-speed air-brakes; Tower couplers; National hollow brake-beams; Pullman system of water delivery; Electric Train Lighting Syndicate, Pintsch system of train lighting; the Baker double coil heating system with commingler; the O. M. Edwards sash balance and trap door fixtures; the Dayton Mfg. Company's platforms, rails and gates, and Miner tandem draft rigging.

The car is finished throughout with St. Jago mahogany. The corner post sheathing, window sills and sign boards being solid and finished in natural wood; the interior in mahogany veneers in marquetry with tulip and white holly. The head linings are of veneered whitewood, enameled and highly polished. The bedrooms, A, B and C, are fitted with all the modern appliances, including electric fans, curling irons, etc. All of the interior metal fittings are of heavy silver plate. The trucks are of the usual six-wheel type fitted with 36 in. wheels and with 4¼ in. x 8 in. journals. The total weight of the car is about 123,000 lbs.



The Canadian Government's New Car Alexandra.

General Plan of New Car for the Canadian Government.



Clearance Outline of New Car for the Canadian Government.

Record Discipline.

The following paragraphs are copied from a monthly bulletin recently issued by one of the Superintendents of the Galveston, Harrisburg & San Antonio, containing notes of discipline administered in the cases of 27 men. It will be observed that of the items which we quote, the first four are commendatory.

A conductor and crew found a bad order car in their train when leaving a terminal, and, to avoid delay, set the car out. The yard engine crew was at the other end of the yard working on another train and was unavailable for prompt service. For this commendable action, a conductor, two brakemen, engineer and firemen are given suitable credits. Such action as this is always appreciated and if brought to notice will always be recognized.

For assisting a yardmaster in setting out a car in a terminal yard, an engineer and fireman are each given suitable credits. In this case the switch engine had been turned in for the day, and a serious delay would have resulted had the engineer and fireman not acted promptly.

For discovering a leak in an oil pipe and taking prompt action in stopping it, an engineer and brakeman are given suitable credits.

For discovering and reporting a broken rail in a switch in a terminal yard, a brakeman has been given credits. This brakeman was not on duty at the time, and his action probably prevented a serious accident.

For standing at and unlocking a switch while a train was passing over it on the main line, a fireman of a light engine on a siding has been given 10 days' record suspension.

For reporting sick when called, a fireman has been given a record suspension of 10 days. Train and engine employees should arrange to notify the office in advance of their inability to go out, as failure to do so frequently results in delays of trains.

For failing to register their watches at terminals, four engineers have been given a record suspension of 10 days each.

An agent at an intermediate station has been reprimanded for not showing the proper interest in connection with a manifest load, set out at his station in bad order. While the conductor was primarily at fault, yet the agent is likewise to blame for the excessive

delay suffered by the car in consequence of his erroneous report.

A conductor in making a terminal register check for his engineer failed to include thereon the information that was necessary, causing a delay to his train, which caused the engineer to go back to check the register for himself. This being his first offence of this kind, the conductor is given a reprimand.

For improper handling of switch, causing derailment of caboose when train was going into a siding, a brakeman has been given 20 days' record suspension.

For going to sleep after being called and causing delay of 25 minutes to an important freight train, two brakemen have been given 10 days' record suspension each.

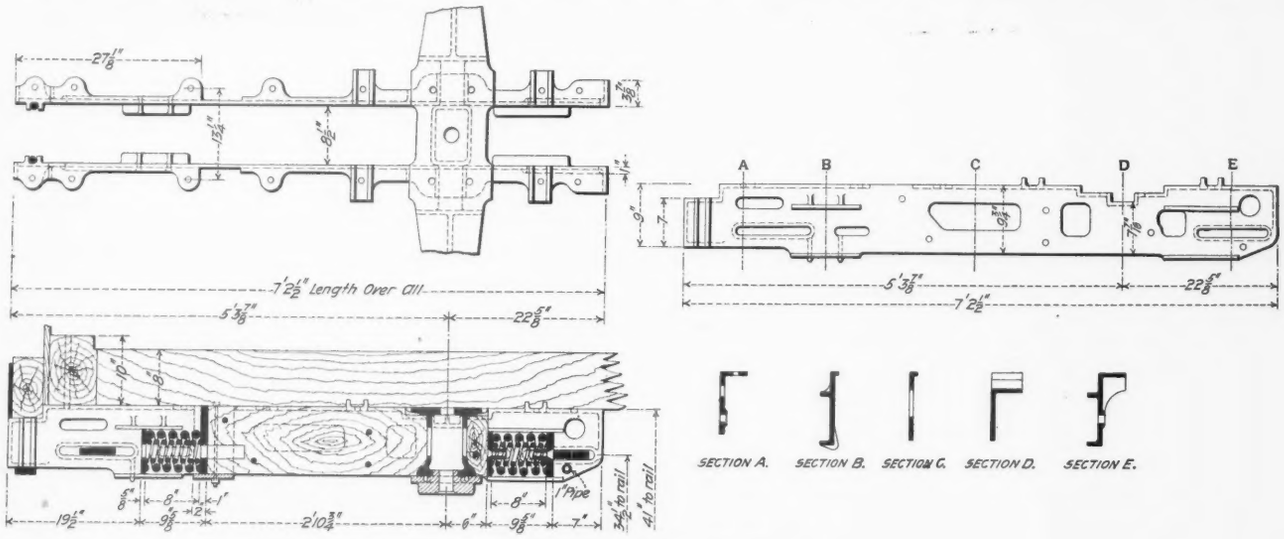
A New Spring Draft Gear.

A lot of 30-ton box cars recently built for the Missouri Pacific, and another lot of equal capacity refrigerator cars built for the St. Louis Refrigerator Company, are equipped with a new type of spring draft gear, drawings of which are shown herewith. As will be seen, the gear extends back of the body bolster, the object being to have the pulling and buffing stresses come directly against the body bolster and by it transmitted to all of the sills of the underframe. The design illustrated is for use with a separable body bolster. The draft sills, which are cast steel, are 7 ft. 2½ in. long and pass through and are bolted to the body bolster. When a solid bolster is used the draft sills are cast in two parts and bolted to the bolster in the front and rear.

Between the draft arms, in front of and bearing against the bolster, is a buffer block of oak, reinforced on the end by a wear plate. A tail bolt passes through the coupler, follower, spring, wear plate and into the buffer block. The follower plates move in channel slides, keeping the spring and tail bolt in alinement.

The rear spring has a small buffer block between it and the bolster. Connection is made from the coupler to this spring by two draft rods attached to keys through the coupler shank and back of the spring respectively.

The principal claims regarding this gear are: Distribution of stresses avoiding shearing and breaking of bolts, couplers, sills, etc.; saving in repairs and reduction of maintenance cost; greater ease in rounding curves and therefore reduced rail, wheel and truck wear; reduced delays in transit; ease of application. It is made by the Busch-Wack Draft Gear Co., St. Louis, Mo.



The Busch-Wack Draft Gear.

Foreign Railroad Notes.

They have had a regular head-on collision in Prussia, which killed 14 people—an almost unheard-of occurrence there. A train was going in one direction in two sections. After the first section had passed a station, the agent signalled a train which it met there to go ahead directly toward the second section. They met on a curve where the enginemen barely had time to set the brakes before they struck.

The Shantung Railroad (the German-Chinese line) for the seven months from its completion, June 1, 1904, to the end of the year earned gross $1,246,037 Mexican, equivalent to a little less than half that sum in gold. During the year 558,868 passengers and 179,270 tons of freight were carried. The freight was largely coal, but the company reports increasing shipments of agricultural products. The working expenses were 51 per cent. of the earnings. The net earnings were about $200,000 gold, five-eighths of which were applied to a renewal fund.

The railroad from Pekin south to Hankow, which a Belgian company is building, is so far advanced that there is talk of opening it through next November. To celebrate that event suitably, and doubtless to secure the highest official approval of this innovation by the foreign devils, the company has had manufactured in France and Belgium a passenger train for the special use of the dowager empress, which is said to be something magnificent.

The Austrian Prime Minister announced to the Parliament July 7 that the government purposes to take over the property of three of the great railroad companies of the country to add to the State system, and eventually a fourth; and that in submitting a bill to effect this he would also submit a plan for the reorganization of the State railroad administration. The present State system consists largely of comparatively unprofitable lines. The three systems which it is now proposed to acquire are the oldest and most important in Austria.

The German railroads—whose fixed year begins with April—on about three-fourths of the mileage, earned in the three months ending with June, nearly 6 per cent. more from passengers and nearly 4 per cent. more from freight than last year. French railroads, which had a somewhat unfavorable business last year, show about 2 per cent. increase in earnings this year. The Austrian railroads have almost exactly the same earnings as last year (½ per cent. more). In Hungary earnings increased 3½ per cent.

The Russian Minister of Transportation reports that at the end of 1904 the total length of railroad open for traffic in the empire (not including the Chinese Eastern) was 32,650 miles, an increase of 240 miles during the year. At that date there were also 3,907 miles under construction, and on 792 miles of this, trains were running, though not fully open for public traffic. Charters had been granted for 2,076 miles more. The gross earnings were about 2 per cent. less in 1904 than in 1903.

The French have completed 515 miles of railroad in Indo-China, mostly in Tong-King. The building of some 1,900 miles was authorized by the French Parliament in 1898. The principal line, from Hanoi up the valley of the Red river to the Chinese border at Laokai was to be done last April, but the country is so unhealthy that the natives would not work there, and it was necessary to import Chinese, who seem willing to work anywhere. Sixty miles of this line remain to be completed.

In Germany, as in England, when grouse shooting opens (Aug. 9), an immense holiday traffic begins, making it very difficult to handle the traffic, and especially the baggage. To help in this latter matter, a train of baggage exclusively was dispatched from Dusseldorf to Erfurt and another from Cologne to Hamburg, and passengers were invited to forward their baggage by these trains before starting themselves, being assured that in such case they would find it on arrival at their destination, which would be much less certain if they had it labeled for the passenger trains on which they started themselves.

GENERAL NEWS SECTION

NOTES.

It is reported that the survey camps along the Grand Trunk Pacific lines under construction east of Winnipeg, are to be put into communication with headquarters by wireless telegraph.

Oregon papers say that the Oregon Railroad & Navigation Company is to use oil for fuel in locomotives between Umatilla and Huntington; also that the roadbed will be oiled to keep down the dust.

A press despatch from Washington says that Mr. Garfield, Commissioner of Corporations in the Department of Commerce and Labor, is to investigate transportation corporations in the same way that he has investigated the beef industry.

The Senate Committee on Interstate Commerce—the Elkins Committee—is to meet at Washington, October 15. It is said that the record will not be reopened for any general hearing, but an exception to this rule will be made in favor of Mr. E. P. Bacon.

A press despatch from Austin says that the principal railroads of Texas have begun injunction proceedings against the state authorities to prevent the enforcement of the law, recently passed, taxing the railroads one per cent. on their gross receipts.

At Little Rock, Ark., the St. Louis, Iron Mountain & Southern is being prosecuted in court for issuing free transportation to State officials and members of the legislature, contrary to the law, which prescribes a fine of from $200 to $250 against both the railroad and the officials in such cases.

The Secretary of War, who has just returned from the Philippine Islands, traveled from Yokohama to Washington in 14 days, 8 hours, the shortest time on record for that journey. From Chicago to Washington (788 miles) Secretary Taft was carried in a special train in 18 hours, 57 minutes.

An officer of the Pan-American Railway Company, the lines of which lie in the hot regions of Mexico, is quoted as saying that during June, July and August not a single employee of the company missed a day of work on account of sickness. This happy result is attributed to the rigid enforcement of hygienic rules.

The Missouri Pacific in replying to a citation for contempt of court tells the United States Circuit Court at Kansas City in substance that it is not guilty of the charge of paying rebates to the Hutchinson & Arkansas River Railroad. A through rate agreement was made with this road on the belief that it was a genuine railroad, and when it was found to be only a yard track of the Hutchinson & Kansas Salt Company the agreement was cancelled.

According to Pittsburg papers, the superintendent of the Middle division of the Pennsylvania has issued an order forbidding employees to accept gifts from shippers. This order has not been occasioned by the discovery of "graft" in connection with some hundred thousand dollar contract; but, according to the reports, is due to trouble which somebody has had over four quarts of milk, at a station where some shipper of milk happened to be unusually generous.

Near Ballard, Washington, on the night of October 2, a passenger train of the Great Northern was stopped by robbers and the express car was blown up with dynamite. It is said that the robbers secured about $1,000. While the robbers were breaking open the safe in the express car, two boys, who had been riding with them on the "blind baggage," but who say they were not members of the gang, went through the passenger cars and "held up" the passengers for their valuables. It is said that the boys had no firearms. The boys were arrested but the dynamiters escaped.

The fall movement of freight appears now to be heavy in all parts of the country. A scarcity of freight cars is reported at Chicago and many other places, and of locomotives at some places. In the bituminous coal traffic to the Atlantic seaboard the strife among shippers for cars is said to be severe. The New York Central, the Reading and the Baltimore & Ohio have issued orders forbidding the loading of their coal cars to points off their own lines. The Reading is short of cars for the anthracite trade also. The movement of iron and steel from Pittsburg is said to be the heaviest in the history of the city.

It is announced in Washington that Interstate Commerce Commissioner Joseph W. Fifer, formerly Governor of Illinois, has resigned, the resignation to take effect three or four months hence. The reports say that the resignation is due to conditions in Mr. Fifer's family and his desire to avoid spending another winter in Washington; but on the same day that this announcement is published the news comes from Chicago that ex-Governor Yates of Illinois is to have Commissioner Fifer's place, Mr. Yates having accommodatingly taken himself out of the way of Senator Cullom's plans for re-election to the Senate.

Testifying before the Interstate Commerce Commission at Chicago last week President E. P. Ripley, of the Atchison, Topeka & Santa Fe, said that the rate on dressed beef between Kansas City and Chicago should be 150 per cent. higher than the rate on livestock. He said it cost less to carry livestock than packing-house products. He read a table showing the cost of hauling carload lots of livestock, dressed beef and packing-house products from Kansas City to Chicago, as follows: "Car of dressed meat, Kansas City to Chicago, $82.19; packing-house products, $85.03, and livestock, $64.77." Mr. Ripley claimed that his company lost money on every car of dressed beef hauled between Kansas City and Chicago.

The State Railroad Commission of Georgia has issued a rule requiring railroads to reweigh carloads of coal and lumber at destination if the consignee so requests. The request must be made within the free time for delivery, and must be accompanied with a deposit of $2, which money is to be refunded if the actual weight proves to be more than 500 lbs. different from the billed weight. The weighing must be done by a sworn weigher in the presence of the consignee and must show the tare—which apparently means two weighings. In case the billed weight is found correct, the two dollars apparently goes to the railroad company. The most beautiful flower of state regulation to be found in this order is, however, a paragraph at the end, which says that the free time for unloading reweighed cars shall begin the next day after the weighing. Where the free time is 48 hours, the consignee who desires 96 hours can at the forty-seventh hour request the reweighing, and his second free-time period will begin the next morning at seven o'clock.

Railroad Y. M. C. A.

At the annual convention of the Railroad Young Men's Christian Associations, at Detroit, last week, it was stated that the number of paying members of such associations is now 74,000, an increase of 12,000 in two years. Associations for street railroad men are now running in three cities. Six traveling railroad secretaries are employed by the International Committee.

Next, an Otoloryngologist.

Officers of the St. Paul and the Illinois Central will grant, it is reported, the request of the Brotherhood of Locomotive Engineers for experienced oculists to ride on engines to determine the condition of the engine drivers' and firemen's sight.—*Exchange.*

In the Bottom Drawer of the President's Desk.

President Roosevelt has returned to Washington and is crowded with business. On his first day Senators Foraker, Dick, McCumber, Burkett, Hemenway and Fulton were among the scores of visitors granted interviews. All came away with one distinct impression—that the President is determined in his stand for practical, adequate and uncompromising rate legislation. He has written that part of his message which deals with this subject, and it has been laid away as a finished product not to be disturbed or revised. The best part of the summer was spent upon it, and the argument is believed by those who have been taken into the President's confidence to be complete and unanswerable. The majority in the Senate will have difficulty in evading the responsibilities that the President puts upon them.—*Washington despatch.*

The Wisconsin Railroad Law.

The new Wisconsin railroad law was framed under the personal direction of Mr. E. P. Bacon, and had the full approval of Governor La Follette; and a majority of the people of the state gave it express or tacit approval by electing Mr. La Follette Governor. But the citizens have not found perfect satisfaction in their new law. One of its provisions was the prohibition of free passes, but now they find that this works against the interests of the state. Large areas of vacant lands in the north have been settled by immigrants who were brought there by real estate agents, and the real estate agents were able to carry on their business because the railroads gave them free or reduced-rate transportation, but they don't get the passes and the immigrants don't come. The railroads are also forbidden to make reduced rates for harvest hands and a farmer must go without the temporary help which he has depended upon in the harvest season. Persons traveling for pleasure can no longer stop over in Wisconsin, the new law forbidding

stop-overs. Even the inmates of soldiers' homes have been chilled by the new law, as they now have to pay their fare when they ride. As for freight rates, the shippers of the state are trembling in their shoes lest somebody shall precipitate a lot of reductions which will deaden manufacturing business.—*Milwaukee Correspondent of the New York Journal of Commerce.*

The Stiles Locomotive and Car Journal Bearings.

The accompanying illustrations, Figs. 1 and 2, show the Stiles locomotive driving bearing made by the A. C. Stiles Anti-Friction Metal Company, New Haven, Conn. The crown of this bearing is formed with a longitudinal groove, from which a number of passages lead transversely to longitudinal channels formed in the inner face of the bearing. Lubricant is applied through the groove in the crown and passes through the inner passages to the longitudinal channeds at the side opposite to the way in which the journal revolves and is carried up between the rubbing surfaces, lubricating the whole surface of the bearing. The usual oiling method provides a channel or oil holes feeding the lubricant at the crown of the bearing. This, it is claimed, causes two troubles; first, it weakens the bearing at the crown, the point where the wear is the greatest; second, the journal sets closest at this point, affording the least possible opportunity for the lubricant to feed. As the revolution of the journal is down from the oil holes and so little of the lubricant can feed on account of the pressure there, it follows that by the time the journal has revolved its last quarter, the lubricant has been pretty well used up. With the Stiles method of feeding from the side the oil is fed at a favorable point on the upper thrust and is carried up and over the entire bearing surface. If desired the channels on one side of the bearing can be filled with tallow, which will remain in place until the journal becomes hot, which might occur on account of neglecting to oil the journal at the proper time. Should this occur, the tallow would supply lubricant for a time and thus prevent a hot journal.

Fig. 3 shows the Stiles car journal bearing. It consists of a bronze shell which is claimed to be of exceptional durability. The bearing point is of the same curvature as the journal, so that should the babbitt be melted out from any cause, the journal would find a perfectly fitting body to run in. Babbitt is interlocked to the shell as shown in the cut, and as the journal wears the babbitt lining it rests in a bed fitted to it at all times. Even after the bronze shell has begun to wear the journal is at all times protected. This is shown in Fig. 4, which is a reproduction of a Stiles bearing which ran upwards of 72,000 miles. In this case the babbitt was completely worn down and the bronze shell had begun to wear. Several of the large railroads are experimenting with this new bearing and interesting results are looked for.

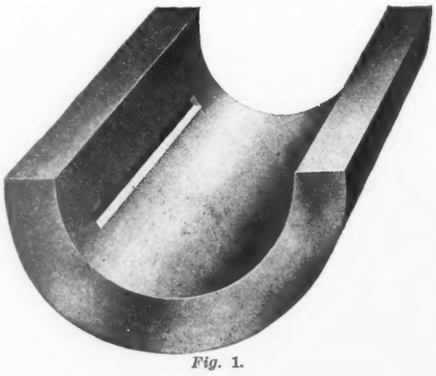


Fig. 1.

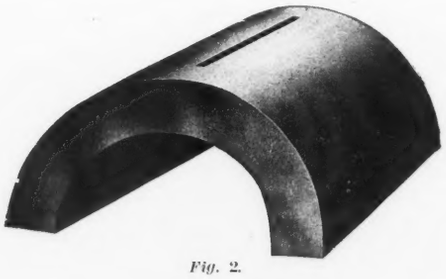


Fig. 2.

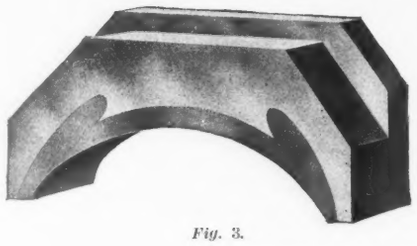


Fig. 3.

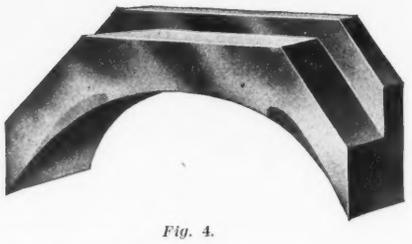


Fig. 4.

The "Stiles" Locomotive and Car Journal Bearings.

B. & O. Improvements on Staten Island.

The Staten Island Rapid Transit Company (controlled by the Baltimore & Ohio), is now engaged in a large amount of new construction work. A dock 476 ft. long by 51 ft. wide, a lighterage pier 485 ft. long and 30 ft. wide, and a car unloader and a new double track foreign freight pier are to be built at Tompkinsville, the freight pier being 800 ft. long and 100 ft. wide. The New York State Construction Company has the contract for building an extension of dock No. 2 and the extension of stone dock No. 5, which, when completed, will give a storage capacity for about 400 cars of stone. The General Contracting and Engineering Company, of New York, is building a new lighterage pier, stone dock and bulkhead at St. George; the pier will be finished about Oct. 15, and the stone dock by Nov. 1. The contract for the new covered pier at Tompkinsville, which will cost in the neighborhood of $300,000, will probably be awarded in the near future.

The entire line from Clifton Junction to Arthur Kill bridge has already been relaid with 85-pound steel rails, and the Rockland Lake Trap Rock Co., of New York, has the contract to furnish the ballast. The trestles at Livingston and Port Richmond and on the east side of the Arthur Kill bridge are being filled, requiring about 5,000 carloads of material to do it. The entire Rapid Transit Division is now automatically block signaled from South Beach to Arlington. A new freight station has been built at Tompkinsville, and a coal and ash handling plant for coaling locomotives at St. George. New waiting sheds and platforms have been built at Port Richmond and Stapleton, and five new switching engines have been ordered for use at St. George. On the Baltimore & New York Railway, which is a part of the Rapid Transit Railway running between Arthur Kill bridge and Cranford Junction, the line has been double tracked for a mile east of Cranford and the entire line will be ballasted with stone. About 3,000 carloads of material have been used in filling the long trestle over the Pennsylvania Railroad at Linden Junction, N. J., and the new eastbound yard at Cranford Junction will be completed by Oct. 15.

Local But Important.

It was rumored yesterday that the Oregon Railroad and Navigation Company was going to put in three new ties and a frog in the yards here. Realizing the error of our ways in the past on railroad news, we determined to follow the example set by the only authoritative railroad sheet in the State, and accordingly we telephoned Mr. J. P. O'Brien (General Manager of the road), the Oregon boy, whom to know is to love, and received the following, which made us feel as if an annual pass wasn't so far off, after all: "No truth in the rumor as to frog. Ties correct." There you are.—*Baker City* (Oregon) *Herald.*

Summary of British Railroad Returns for 1904.

The returns relating to the capital, traffic, receipts and expenditure of the railroad companies of the United Kingdom for 1904 and the Board of Trade report thereon, show that the total amounts of railroad capital at the end of 1904, compared with the corresponding amounts at the end of 1903, mark an increase of 114⅓ million dollars. The proportions which these various classes of stock bore to the total paid-up capital differed, however, but slightly from those that had been obtained at the end of the previous year. In 1903 the increase over 1902 was 136 million dollars. The following table shows the amounts paid up at the end of 1904, and nominal additions:

	Total paid-up capital.		Amt. in paid-up capital*	
Class of stock.	1904, Million $.	Increase in 1904 over 1903, Million $.	1904, Million $.	Increase in 1904 over 1903, Million $.
Ordinary stock	2,330	37.8	428.	5.83
Guar. and preferred stock	2,170	44.7	296.	2.43
Loans and debenture stock	1,650	31.6	215.	2.92
Total	6,150	114.1	939.	11.18

*Amount included in paid-up capital, representing nominal additions on the consolidation, conversion and division of stocks.

The average dividends paid on the various classes of capital in 1904 were practically the same as in 1903, with the exception of the rate of interest on loans, and were approximately 3¼ per cent. on the ordinary capital, 3½ per cent. on the preference, 4 per cent. on the guaranteed, and 3½ per cent. on the debenture stock. The rate of interest on loans, however, fell from 4.46 to 4.11 per cent. The proportion borne by the actual net earnings to the total capital was 3.36 per cent. as compared with 3.40 per cent. in 1903.

Excluding the nominal additions to capital, however, the proportion would be 3.97 per cent.

The gross receipts of the companies from passenger and freight traffic as compared with 1903, are shown below:

Receipts from	1904. Million $.	Increase Amount, Million $.	Increase Per cent.
Passenger traffic	235.	1.95	0.9
Freight traffic	269.	1.46	0.5
Total	504.	3.40	0.7

In passenger traffic a slight decrease in the receipts from ordinary passengers was more than balanced by an increase in season ticket receipts:

Receipts from	1904.	Increase (+) or decrease (—) Amount.	Per cent.
Ordinary passengers:			
First-class	$16,700,000	(—) $481,000	(—)2.8
Second-class	15,900,000	(—) 325,000	(—)2.0
Third-class	143,000,000	(+) 528,000	(+)0.4
Season ticket holders	19,400,000	(+) 679,000	(+)3.6
Parcels, mails, horses, etc.	40,400,000	(+) 1,640,000	(+)4.2
Total	$235,400,000	(+)$2,041,000	(+)0.9

The average receipts for all classes fell from 14.8 cents to 14.6 cents.

Receipts from each branch of freight traffic in 1904 and 1903 are shown in the table below:

Receipts from	1904.	Increase (+) or decrease (—) Amount.	Per cent.
Minerals	$125,000,000	(+)$1,560,000	(+)1.3
General merchandise	138,000,000	(+) 170,000	(+)0.1
Live stock	6,840,000	(—) 321,000	(—)4.5
Total	$269,840,000	(+)$1,409,000	(+)0.5

The tonnage of minerals conveyed was 349.6 million tons, an increase of 5.9 million tons, or 1.7 per cent., while that of general merchandise was 100.3 million tons, an increase of 0.3 million tons, or 0.3 per cent.

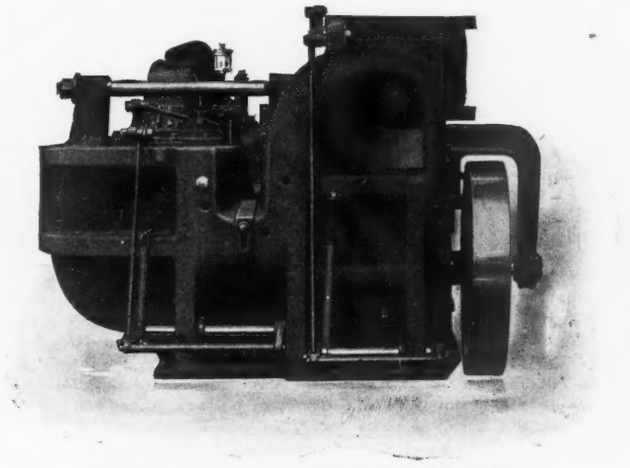
The total operating expenses in 1904 amounted to $336,000,000, an increase of $2,970,000, or 6.9 per cent., but the proportion of expenses to receipts was the same as in 1902 and 1903, namely, 62 per cent. In 1901 the proportion was 63 per cent., the highest ever reached. Below will be found a comparison in different items of expenditure:

	1904. Million $.	Million $.
Maintenance of way	51.4	(+)0.34
Locomotive power	89.8	(—)0.146
Carriages and wagons	27.4	(+)0.243
Traffic expenses	99.4	(+)0.585

The total increase under these four heads was $1,020,000, which compares with an increase under the same heads in 1903 of $1,850,000. The mileage of railroads open for traffic in 1904 was 22,634 miles, as against 22,435 in 1903, of which totals 12,590 miles and 12,500 miles respectively were double line or more. Net earnings in 1904 (after deducting working expenditure) were $207,000,000, representing an increase of $1,620,000, or 0.8 per cent., but the proportion of net earnings to total capital shows a decline of 0.04 per cent.

The New Ajax Universal Forging Machine.

The new Ajax universal forging machine shown in the accompanying illustration, while retaining all the features of the well-known Ajax heading, upsetting and forging machine, has in addition a powerful vertical press which can be used for forging, bending and trimming. This press has a vertical movement of from 3 in. to 5 in., according to the size of the machine. There is a screw adjustment to the stroke of the head which enables the operator, when setting the dies, to bring them to the exact point desired. The vertical movement of the head is obtained by heavy links connected at the lower end with levers on which are eccentric hubs which give the head the desired throw or stroke. These levers in turn are connected to a slide placed horizontally in the machine and actuated by an eccentric shaft in the back end of the machine. The mechanism that operates the vertical forging press is entirely separate and independent of that which operates the forging machine, although both are in the one bed. The forging press is operated by depressing the pedal shown on the right of the machine. This allows the lock, between the eccentric shaft and header slide, to drop into place and the operator can give one or more blows as desired. On taking the foot off the pedal the lock is released automatically and the forging press comes to a stop with the dies wide open.

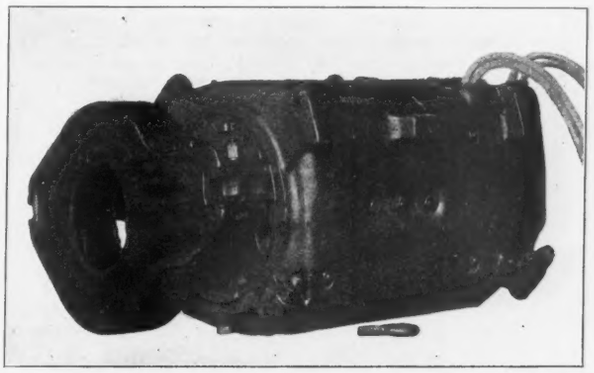


The New Adjax Universal Forging Machine.

The locking device for the forging press is the same as used in the Ajax heading, upsetting and forging machine. By using this machine it is claimed that forgings can be made at a much lower cost than formerly through the saving of heats and handling, and many intricate forgings heretofore impossible to make on forging machines can be readily turned out by this tool. These machines are built in seven sizes, known to the trade as A, B, C, D, E, F and G, and the bed is of the box form type, cast solid in one piece. The weights of the machines vary from 18,000 lbs. for the A machine to 180,000 lbs. for the G machine. This tool is made by the Ajax Mfg. Co., Cleveland, Ohio, and is the invention of J. R. Blakeslee, Jr., General Manager of the company.

A New Design of Railroad Motor.

The accompanying illustration shows a new design of railroad motor made by the Westinghouse Electric & Mfg. Co., New York. The smallest motor of the new design has a capacity of 75 h.p. and the largest 200 h.p., with a number of sizes between the two. Limitations are naturally placed on the size and construction of a railroad motor by the amount of available space on the truck of the car; therefore a frame of square cross-section has been adopted as utilizing this space most advantageously. All motors in this line have cast-steel frames split at an angle of 45 deg. with the horizontal. The axle bearings are carried by the lower half of the field frame and are divided at an angle of 35 deg. with the perpendicular, so that the weight of the motor is supported almost entirely by the part of the frame extending over the axle rather than by the axle cap bolts. By lifting off the upper half of the field casting the armature may be removed from the frame without taking the motor from the truck; or the motor may be removed from the truck by simply taking off the gear case and axle caps. The housings for the armature bearings are circular in form and are turned slightly larger in diameter than their seats in the frames so that when clamped in place all the advantages of a press fit are obtained. Finished shoulders on the housings prevent any lateral movement and also take the entire end thrust of the armature instead of imposing this severe strain on the clamping bolts.



A New Westinghouse Railroad Motor.

The armature bearings are made of solid phosphor-bronze bushings, with a $^3/_{32}$-in. lining of babbitt metal. Both oil and waste lubrication are provided. The waste comes in contact with the bearings on the low pressure side and is supplied with oil from separate pockets from below; in this way it is filtered before reaching the bearing. The amount of oil in the reservoirs may be gaged so that it may be kept at the proper level for economical service. With intelligent care, it is claimed that these bearings will run 100,000 to 150,000 miles.

The axle bearings are similar in construction to those of the commutator, except that split bushings are used. Pole pieces are built up of punchings of soft steel, and are bolted to the top, bottom and sides of the motor frame, which being almost square in cross-section permits the use of flat field coils. The armature core is also built up of steel punchings and is keyed on a cast-steel spider which carries the commutator. The shaft is forced

into the finished armature and is keyed to it, and may be removed, should necessity arise, without disturbing the windings or commutator. The armature coils are strap wound and made in two parts. As the top coils are more liable to injury this design makes it possible to remove the damaged part without disturbing any other part of the winding. The coils are liberally insulated with mica, and sealed and further insulated by dipping in varnishes which are oil-proof and moisture-repelling. On each end the armature slots are made deeper and wider, thereby providing space for mica cells, which greatly reinforce the insulation at these points. As a further protection fiber strips are taped to the upper sides of the top coils. A bell-shaped flange at the pinion end and a cylindrical flange on the commutator end form rigid supports for the windings. Countersunk bands of steel wire on the core and wide bands outside the core hold the coils firm and secure. Openings through the spider and core allow a free passage of air, which is thrown forcibly against the field coils, thus maintaining a low temperature throughout the motor. The commutators are made up of a number of hard drawn copper bars with short necks, carefully insulated from each other and held securely between insulated V rings. The brush holders are of the sliding type with springs of phosphor-bronze. The tension of the spring may be adjusted without removing the holder from the motor. The brush holder proper is bolted to an insulated guide and may be removed without disturbing the insulation or connections. Leads of flame-proof flexible rubber-covered cable are brought out at the front of the motor over the commutator through insulating bushings. Access to the brushes and brush-holders is provided through a large opening in the frame over the commutator which extends well down the side, making inspection easy from the pit. A hole in the rear end bell and an opening under the commutator provide means for inspecting the clearance between the armature and field poles.

Manufacturing and Business.

The Madison plant of the American Car & Foundry Company has added to its equipment 100 "Boyer" long stroke riveting hammers, made by the Chicago Pneumatic Tool Co., Chicago.

At a meeting of the Board of Directors of the Railway Steel-Spring Company, New York, held September 29, 1905, Mr. F. F. Fitzpatrick was elected Vice-President of the company and manager of its Sales Department.

The Enterprise Railway Equipment Company, Chicago, has filed papers of incorporation at Springfield, Ill., for the purpose of making railway supplies. The incorporators are: James T. Milner, Argyle Campbell and Ambrose Risdon.

The Ingersoll-Rand Company, New York, has opened a branch office at Houghton, Michigan, under the management of Mr. T. F. Lynch. At the new office a complete stock of repair and duplicate parts for all Ingersoll-Rand machinery will be carried.

Mr. O. A. Stranahan has been appointed as sales manager and M. C. Miller has been appointed as assistant sales manager of the Allis-Chalmers Co., Milwaukee, Wis. W. T. McCaskey has also been appointed as special representative of the above company in matters pertaining to the equipment of interurban railroads and hydro-electric projects.

Compressed Air, a modest monthly publication at No. 11 Broadway, New York, has in its September issue a full description of the method of working the Iselin colliery of the Pittsburg Gas Coal Company. The illustrations show in detail not only the methods of using compressed air, but also the interesting engineering features of this considerable undertaking. It is worth while to those who are interested in this subject.

The International Acheson Graphite Company, of Niagara Falls, N. Y., has doubled the capacity of its plant for creating graphite in the elctric furnace, and has contracted with the Niagara Falls Power Company for another 1,000 h.p. of electrical energy in addition to the 1,000 h.p. previously used. The commercial importance of this artificial graphite may be estimated from the fact that the United States Geological Report for 1904 states that for that year the value of Acheson graphite produced was $217,790, while all the graphite mined in this country amounted to $341,372. New York state, which is considered rich in deposits, according to the official report of 1904 produced natural graphite worth $119,509. Acheson graphite is largely used in the manufacture of metal protective paints, dry batteries, stove polish, packing and as a lubricant. The electro-chemical processes also consume an extensive supply.

Iron and Steel.

The Illinois Central is ready to order 75,000 tons of rails, and the Rock Island 60,000 tons.

The Colorado Southern, New Orleans & Pacific has ordered 31,000 tons of rails to be delivered at Fort Worth.

The Grand Trunk Pacific has inquired in Scotland for 30,000 tons of rails. This company recently ordered delivered 5,000 tons of rails of the United States Steel Corporation.

Efforts are being made by car companies to place blanket contracts for structural shapes and plates for delivery during the first half of 1906. One company is in the market for upward of 25,000 tons, and is finding difficulty in placing the contract.

The Jones & Laughlins Co. has plans ready for the extension of its mills on the South Side (Pittsburgh). No. 13 mill is to be enlarged. It is reported that the company is preparing to remove its bridge department from the South Side Works to Colonia, near Monaca.

Business in structural material continues brisk, railroads being the largest buyers. The American Bridge Co. has booked an order for about 1,200 tons of steel for a new bridge for the Birmingham & Atlantic. It is expected that the contract for supplying the 12,000 tons of steel for the new Ohio river bridge at Ironton, Ohio, will soon be let. The 160,000 tons required by the New York Central is said to have been ordered. The Carnegie Steel Co. has just booked orders for 50,000 to 60,000 tons of rails for 1906 delivery and it is estimated that the total tonnage of rails booked by the mills for 1906 delivery is now between 1,800,000 and 2,000,000 tons, of which the Illinois Steel Co. has secured more than half. The Republic Iron & Steel Co. also has obtained some big orders within the last week. Contracts for steel plates are being placed in large volume. Orders for plates and small shapes, aggregating about 50,000 tons, for 10 additional lake ore boats, have just been taken by the Carnegie Steel Co. and the Illinois Steel Co., and orders for 50,000 tons additional will soon be given by shipbuilders.

PERSONAL.

—Mr. S. M. Prevost, Third Vice-President of the Pennsylvania, died at his home in Philadelphia last Saturday at the age of 61. He was born in Philadelphia. He graduated from the Polytechnic College there and entered railroad service as rodman in an engineer corps engaged in the construction of the Philadelphia & Erie. In 1871, he was appointed Assistant Engineer of Maintenance of Way on the Philadelphia division of the Pennsylvania, and in 1874 was promoted to be Superintendent of the Bedford division. He advanced through various positions until May 1, 1885, when he was made General Superintendent of Transportation of the Pennsylvania Lines East of Pittsburg. He was appointed General Manager in 1895, and elected Third Vice-President in 1897. He was a director of the Baltimore & Ohio, the Chesapeake & Ohio, the Norfolk & Western, and of other companies.

—Mr. W. H. Newell, who was recently made Superintendent of Transportation of the First division of the Atlantic Coast Line, was born in 1857, and began railroad work on that road in 1877 as telegraph operator. He was successively agent-operator, freight conductor, passenger conductor and station master until 1893, when he was made trainmaster at Norfolk, Va. In 1898, he was appointed Assistant Superintendent of the Norfolk district, and in 1902, Superintendent of that district. He was transferred to the Charleston district last April, and now leaves that place to accept his present appointment.

—Mr. W. E. Knox, who has been appointed General Freight Agent of the Atlanta & West Point and the Western of Alabama, entered railroad service in 1879 as a telegraph operator on the Cincinnati & New Orleans. In 1887, he became Superintendent and General Freight and Passenger Agent of the Tennessee & Coosa. In 1888, he went to the Anniston & Cincinnati. This road was soon consolidated with the Louisville & Nashville, and in August, 1893, Mr. Knox was made Superintendent of the Louisville & Nashville at Anniston, holding that position until August of this year, when he was appointed general agent at the same place. He was appointed to his present position on September 17.

—Mr. J. M. Brown, who was recently appointed Engineer of the Central district of the Chicago, Rock Island & Pacific, began railroad work in a surveying party of the Burlington, Cedar Rapids & Northern in 1879. He was in charge of some construction for that road and was also engaged in office and maintenance of way work until 1890, when he was made Division Engineer. During the three years beginning in 1899 he had charge of construction of lines in northern Iowa and Minnesota and of terminals at St. Paul and Minneapolis. In 1903, he went to the Rock Island, where he took charge of the construction of the Moline shops. In 1904 he was appointed Engineer of the Cedar Rapids division, where he remained until appointed to his present position.

ELECTIONS AND APPOINTMENTS.

Baltimore & Ohio.—P. J. Harrigan, General Foreman at Connellsville, Pa., has been appointed Master Mechanic, retaining his former headquarters.

Buffalo, Rochester & Pittsburg.—W. R. Shoop has been appointed Purchasing Agent, with office at Rochester, N. Y.

Canadian Pacific.—O. O. Winter, Division Superintendent at Fort William, Ont., has not resigned, as was reported.

Chicago, Rock Island & Pacific.—W. L. Darling, Chief Engineer, has resigned, effective on the appointment of a successor.

W. J. Leahy, Assistant General Passenger Agent at St. Louis, has been appointed First Assistant General Passenger Agent with office at Chicago.

Columbia Southern.—J. P. O'Brien, Vice-President and General Manager of the Oregon Railroad & Navigation, has been also elected President of the Columbia Southern.

Cumberland Valley.—A. J. Cassatt, President of the Pennsylvania, has also been elected President of this road, succeeding the late Thomas B. Kennedy.

Erie.—Robert Bacon, who was recently appointed Assistant Secretary of State, has resigned from the board of directors of the Erie.

Grand Trunk.—The lines and branches heretofore known as the Canada Atlantic are now operated as the Ottawa division of the Grand Trunk. It is divided into three districts, to be known as the Thirtieth district, 175 miles; Thirty-first district, 151 miles, and Thirty-second district, 134 miles.

M. Donaldson has been appointed Superintendent of the Ottawa division, and James Ogilvie, Master Mechanic, both with headquarters at Ottawa, Ont.

Great Northern.—H. A. Kennedy, Assistant General Superintendent with headquarters at Spokane, Wash., has been appointed Acting General Superintendent during General Superintendent T. Slade's extended leave of absence.

Marietta, Columbus & Cleveland.—J. T. Blair, President of the Little Kanawha, has been also elected President of the Marietta, Columbus & Cleveland, succeeding D. I. Roberts, resigned. A. H. Blair has been elected Secretary and Treasurer. Samuel D. Brady, Chief Engineer of the Little Kanawha, has been also appointed Chief Engineer of the Marietta, Columbus & Cleveland. The general offices are at Marietta, Ohio.

Mexican Central.—James Piper has been elected Secretary.

Missouri Pacific.—The lines of this company and of the St. Louis, Iron Mountain & Southern are now operated in three grand districts. The Northern district, operating 2,487 miles, consists of the line from St. Louis to Pueblo, Colo., via Kansas City; from Kansas to Omaha and intermediate branches; from Kansas to Virginia, Neb., including the Leavenworth branch; from Atchison to Lenora and intermediate branches, and from Topeka to Fort Scott and the Great Bend branch.

The Southern district, operating 1,864 miles, consists of the line from St. Louis to Texarkana via Little Rock, with intermediate branches in Missouri; from Thebes to East St. Louis and intermediate branches; from Knobel to Helena; from Bald Knob to Memphis; from Little Rock to Alexandria; from Latour to Clayton; from Arkansas City, Ark., to Warren; from White to Vidalia, and from Gurdon to Eldorado.

The Central district, operating 1,991 miles, consists of the line from Pleasant Hill to Joplin and intermediate branches; all lines in Kansas south of the main Kansas City-Pueblo line, except the line from Fort Scott to Topeka and Great Bend branch, but including the Kanopolis branch; also the line from Coffeyville to Fort Smith Crossing, including intermediate branches, and from Carthage to Diaz, including intermediate branches.

E. A. Gould, heretofore General Superintendent of the Missouri Pacific at Kansas City, is General Superintendent of the Northern district with office at Kansas City, Mo. W. T. Tyler, heretofore General Superintendent of the St. Louis, Iron Mountain & Southern, is General Superintendent of the Southern district with office at Little Rock, Ark. A. DeBernardi, heretofore Superintendent at Osawatomie, Kan., is General Superintendent of the Central district with office at Coffeyville, Kan.

K. G. Morley, Division Superintendent at McGehee, Ark., has resigned. J. W. Dean has been appointed Superintendent of Terminals at Little Rock, Ark., succeeding J. A. Abrams, resigned.

S. M. Dolan, Master Mechanic at the Baring Cross, Ark., shops, has been transferred to the new shops at Sedalia, Mo. B. E. Stevens, General Foreman of the Locomotive Department of the Illinois Central, succeeds Mr. Dolan. A. M. Machin, Master Mechanic at Baring Cross, Ark., has resigned. A. McCormick, Master Mechanic of the Colorado Springs & Cripple Creek districts, succeeds Mr. Machin.

Norfolk & Southern.—Marsden J. Perry has been elected President, and Frank L. Gannon, Vice-President, succeeding R. S. Scoville, resigned.

M. W. Maguire, who recently resigned the position of Superintendent of the Chattanooga division of the Cincinnati, New Orleans & Texas Pacific, has been appointed General Superintendent of the Norfolk & Southern, having charge also of maintenance of way and equipment.

Northern Pacific.—J. P. Morgan, Jr., has been elected director, succeeding the late Daniel S. Lamont.

Oregon Short Line.—J. A. Reeves, Assistant General Freight Agent, has been appointed General Freight Agent with office at Salt Lake, Utah.

Wabash.—H. H. Wellman, Purchasing Agent, has resigned. C. A. How, Supply Agent, succeeds Mr. Wellman.

Wheeling & Lake Erie.—The lines of this road, the Wabash-Pittsburg Terminal and the West Side Belt, east of and including Sherodsville, Ohio, are now operated as the Pittsburg division. The lines west of Sherodsville, including Navarre, Ohio, and the Huron branch, are operated as the Toledo division.

C. V. Wood, heretofore Superintendent of Terminals at Pittsburg, Pa., has been appointed Superintendent of the Pittsburg and Cleveland divisions with headquarters at Canton, Ohio. C. A. Van Dusen, heretofore Assistant Superintendent at Toledo, Ohio, has been appointed Superintendent of the Toledo division with office at Canton, Ohio. C. W. Coe, Trainmaster at Columbia, Ohio, has been appointed Assistant Superintendent of the Pittsburg division with headquarters at Rook, Pa.

LOCOMOTIVE BUILDING.

The Northern Pacific is in the market for some locomotives.

The Oliver Mining Company (Duluth) is in the market for some locomotives.

The Grand Trunk Pacific, it is reported, has placed a large order for locomotives with the Montreal Works of the American Locomotive Co.

The Midland Steel Company has ordered two six-wheel switching locomotives from the American Locomotive Co. The total weight of each engine will be 150,000 lbs.

The Isthmian Canal Commission, as reported in our issue of September 22, has ordered 120 locomotives from the American Locomotive Co. Of these, 100 are for March, 1906, delivery, and the remaining 20 are to be delivered in June, 1906.

The New York, New Haven & Hartford has ordered 25 electric locomotives from the Westinghouse Electric & Manufacturing Co. A brief description of these locomotives was printed in the *Railroad Gazette* September 29. They will be operated by the single-phase alternating current system without the use of a third rail.

The Chicago, Milwaukee & St. Paul, as reported in our issue of September 22, is building 10 simple 10-wheel (4-6-0) locomotives at its West Milwaukee shops, for delivery beginning December 1. These locomotives will weigh 244,700 lbs., with 228,000 lbs. on the drivers; cylinders, 21 in. x 30 in.; diameter of drivers, 69 in.; wagon top boilers, with a working steam pressure of 200 lbs.; heating surface, 2,919 sq. ft.; 350 National Tube Co.'s tubes, 2 in. in diameter and 15 ft. long; firebox, 9 ft. 11⅝ in. long and 3 ft. 5⅛ in. wide; grate area, 34.16 sq. ft.; tank capacity, 7,000 gallons, and coal capacity, 10 tons.

The Central of New England, as reported in our issue of September 22, has ordered 10 simple consolidation (2-8-0) locomotives from the Rogers Locomotive Works, for delivery November 15 to December 1. These locomotives will weigh 244,700 lbs., with 228,000 lbs. on the drivers; cylinders, 20 in. x 24 in.; diameter of drivers, 50 in.; extended wagon top boilers, with a working steam pressure of 180 lbs.; heating surface, 2,187.43 sq. ft.; 312 charcoal iron tubes, 2 in. in diameter and 12 ft. 6 in. long; steel firebox, 104⅛ in. x 42¾ in.; grate area, 31.02 sq. ft.; tank capacity, 5,000 gallons, and coal capacity, eight tons. The special equipment includes: Westinghouse air-brakes, Gollmar bell ringers, Sterlingworth brake-beams, Tower couplers, Dressel headlights, Ajax journal bearings, Jerome piston and valve rod packings, Leach sanding devices, Nathan sight-feed lubricators, Pittsburg Spring & Steel Co.'s springs, American steam gages and Latrobe driving wheel tires.

CAR BUILDING.

The Northern Pacific has asked for bids on 5,000 box cars.

The Maine Central, it is reported, is asking bids on 250 box cars.

The Louisville & Nashville will build 1,000 coal cars at its own shops.

The New York Central & Hudson River is reported as figuring on box cars.

The Southern, it is reported, has ordered 1,500 cars from the Detroit Car Works.

The Erie has ordered five refrigerator express cars from the Pullman Co.

The Cleveland Electric, it is reported, is in the market for 50 passenger cars.

The Canadian Pacific is reported to be asking prices on about 3,000 cars in the United States.

The Duluth & Iron Range has ordered 750 steel hopper cars from the Pressed Steel Car Co.

Street's Western Stable Car Line, it is reported, is asking prices on upwards of 1,000 stock cars.

The Pittsburg & Lake Erie has ordered 200 drop bottom gondola cars from the Pressed Steel Car Co.

The Chicago, Rock Island & Pacific has asked prices on about 1,000 box cars and 250 furniture cars.

The Chicago, St. Paul, Minneapolis & Omaha is reported to be in the market for about 53 passenger cars.

The Philadelphia & Reading is reported to have ordered 2,100 of the 6,000 cars for which they are in the market.

The Toledo & Ohio Central, it is reported, has ordered 500 drop bottom gondola cars of 100,000 lbs. capacity from the Ralston Car Co.

The Chicago, Milwaukee & St. Paul is in the market for about 25 coaches, 10 sleepers, four tourist and some dining and observation cars.

The Chicago & Southern Traction Co. has ordered 10 passenger cars from the St. Louis Car Co., instead of 66 cars, as reported in our issue of September 29.

The Johnson Automatic Refrigerator Line, as reported in our issue of September 15, has ordered 250 refrigerator cars from the American Car & Foundry Co.

The Baltimore & Ohio has ordered 10 horse express cars from the Pullman Co., and is also reported as having ordered 500 coal cars from the American Car & Foundry Company.

The St. Louis, Brownsville & Mexico has ordered 15 passenger cars from Barney & Smith and 100 stock cars, 50 box cars and 40 refrigerator cars from the American Car & Foundry Co.

The New York, New Haven & Hartford, it is reported, has ordered 2,000 box cars from the Standard Steel Car Co., and 500 box cars from the Keith Manufacturing Company.

The Duluth, Missabe & Northern has ordered 500 steel hopper cars from the Pressed Steel Car Co., and is said to be figuring on about 300 flat cars, 25 box cars and 25 refrigerator cars.

The Chicago, Lake Shore & Eastern, as reported in our issue of September 22, has ordered 200 flat cars and 800 gondola cars of 100,000 lbs. capacity from the Western Steel Car & Foundry Co.

The Choctaw Railway & Lighting Co. has ordered two interurban 34-ft. steel channel bottom semi-convertible cars from the St. Louis Car Co. Arthur Underwood, Marquette Building, Chicago, is President.

Wm. J. Oliver, Contractor, Knoxville, Tenn., has ordered 20 Hart convertible cars and one Rodger distributing car from the Rodger Ballast Car Co. The 20 convertible cars are to be used in construction service.

The Mobile & Ohio has ordered 100 60,000 lbs. capacity hopper coal cars and 100 80,000 lbs. capacity Rodger ballast cars from the American Car & Foundry Co. The special equipment includes: Steel axles, Scullin-Gallagher bolsters, Damascus brake-beams, Westinghouse brakes, Ajax brasses, Chicago couplers and Miner D.174 draft rigging.

The Atchison, Topeka & Santa Fe has ordered 13 cabooses from the American Car & Foundry Co. These will be 33 ft. 1⅝ in. long over buffer beams and 9 ft. 1½ in. wide over sills. The special equipment includes: Kewanee brake-beams, Westinghouse air-brakes, R. E. Janney couplers, Miner draft rigging and McCord journal boxes.

The Chicago, Milwaukee & St. Paul, as reported in our issue of September 29, is building 700 gondola cars of 100,000 lbs. capacity at its West Milwaukee shops. The cars will weigh 42,000 lbs., and measure 42 ft. long, 10 ft. 1½ in. wide and 8 ft. 6⅝ in. high, over all. The special equipment includes: Congdon brake-beams, New York air-brakes and Hennessey double friction couplers.

The Nashville, Chattanooga & St. Louis has ordered six wide vestibule passenger cars from the Pullman Co. They will be 68 ft. long, 10 ft. ¼ in. wide and 14 ft. 2¼ in. high over all. The special equipment includes: Pullman axles, bolsters, brake-shoes, brasses, dust guards, journal boxes, paint and vestibules; "Diamond" special brake-beams, Westinghouse air-brakes, National couplers, Forsyth curtain material, Westinghouse friction draft rigging, Pintsch light, Railway Supply Co.'s springs and Paige wheels.

The Canadian Pacific, as reported in our issue of September 29, will build 29 65-ft. suburban cars, 27 67-ft. colonist cars, 25 65-ft. first class cars, 14 72-ft. sleeping cars, 10 60-ft. baggage and express cars, eight 60-ft. baggage and mail cars, eight 65-ft. café cars, five 72-ft. dining cars, five 60-ft. fruit express cars, four 72-ft. parlor cars, four 65-ft. café parlor cars, four 65-ft. baggage and smoking cars, 1,136 box cars of 60,000 lbs. capacity, 653 flat cars of 60,000 lbs. capacity, 524 stock cars of 60,000 lbs. capacity, 500 Rodger ballast cars, 50 refrigerator cars, 35 coal cars of 80,000 lbs. capacity, and five snow plows at its Angus, Montreal, shops; also, will build 37 standard vans at its Farnham shops.

BRIDGE BUILDING.

Aberdeen, Wash.—A contract has been let to the Pacific Steel Co. for building a steel bridge over the Wishkah river at Heron street. P. F. Clark is City Clerk.

Booneville, Mo.—Heavy rains and high water in Cooper County recently destroyed highway bridges which it will cost about $500,000 to replace.

Camden, N. J.—Bids are wanted by the county collector Oct. 30 for a bascule highway and electric car bridge to be built over Coopers Creek, at this place. Fred W. George, Court House, will furnish information.

Durango, Colo.—This city is planning to build a bridge over the Ammas river, at Main avenue. The proposed bridge will consist of two spans of 60 ft. each, with 34 ft. roadway and 5 ft. sidewalks. Plans are to be submitted for a steel or a concrete and stone structure.

Evansville, Ind.—Bids are wanted by the Board of County Commissioners October 9 for building six concrete bridges and one steel bridge in Vanderburg County. Harry Stinson is County Auditor.

Gainesville, Ga.—The County Commissioners have under consideration the question of building a new bridge over the Chattahoochee river at New Bridge, three miles north of this place.

Harrison, N. J.—At a recent meeting of the joint committees on free bridges of Essex and Hudson County Board of Freeholders, it was decided to build a new bridge over the Passaic river at Clay street. The proposed bridge is to have a draw of the rolling lift type and is to cost about $125,000. The Public Service (street railroad) Corporation will be asked to pay one-third of the cost of this structure.

Hillsdale, Ind.—Bids are wanted by H. T. Payne, county auditor at Newport, Oct. 19, for building two steel or concrete bridges, 50 and 37 ft. respectively.

Norfolk, Va.—The Tidewater Railroad has given a contract to Bates & Rogers, of Chicago, for building its double track bridges over the southern and eastern branches of the Ely river, at this place, to cost about $250,000.

Pensacola, Fla.—The date for receiving bids for the steel bridge to be built over the Perdido river, in Escambia County, has been postponed to July 1, 1906. A. M. McMillan is county clerk.

Philadelphia, Pa.—Plans have been completed for building four bridges, for which bids will soon be asked by City Engineer Webster. The cost is to be paid for out of the $16,000,000 loan provided for bridge work. Bridges will be built over the Wissahickon at Allen's lane; on Wyoming avenue over the Philadelphia & Newton tracks; at Twenty-fifth street over the Pennsylvania tracks, and at Front street over the Pennsylvania tracks. One-third of the cost of the Wyoming avenue bridge is to be paid by the railroad, and the Philadelphia Rapid Transit Co. will pay for paving and grading. The Pennsylvania will share with the city the cost of the bridges over its tracks.

Spokane, Wash.—The Board of Public Works has reported to the City Council the estimated cost of building a new bridge over the third channel of the river at Howard street, as furnished by City Engineer McIntyre, as follows: For a steel highway bridge with 35-ft. roadway and two 7½-ft. sidewalks, $18,755; a heavier bridge of similar construction to carry street cars, $24,920; for a combined wood and steel structure heavy enough to carry street cars, $13,453.

Trenton, N. J.—Pennsylvania papers report that the Pennsylvania Railroad is to build another bridge across the Delaware, between Trenton, N. J., and Morrisville, to carry a freight line which is to run around the City of Trenton. The proposed location of the new line is south of the present main line stone arch bridge which was completed a year or two since.

Van Buren, Ark.—Plans have been completed for the proposed bridge to be built over the Arkansas river to carry the tracks of an electric railroad. The bridge will consist of 10 spans; total length, 2,200 ft.

Vancouver, B. C.—The Eleventh avenue bridge, which was re-

cently condemned by City Engineer Clements, will soon be replaced by a concrete structure.

WASHINGTON, D. C.—The lowest bid submitted for building a concrete steel bridge, 162 ft. long between abutments, 202 ft. over all and 64 ft. wide, to consist of three spans, over the head of the Washington channel, which will form part of the Washington approach to the Potomac highway bridge, was that of the Penn Bridge Co., of Beaver Falls, Pa., whose bid was $97,367, with a higher bid amounting to $109,500 if stone facing is to be used, the work to be completed by Oct. 15, 1906. There were about nine other bidders, whose bids ranged from this figure to $204,000 without stone facing and $226,000 with stone facing, with a time limit for the completion of the work to August 31, 1907.

YARDLEY, PA.—According to Pennsylvania newspapers, the high bridge of the Philadelphia & Reading across the Delaware at this place is to be superseded by a four-track stone arch bridge. The present bridge is 80 ft. above the water. Nine arches will be required to cross the river, and shorter spans will be built over the railroad tracks, wagon roads and canals on the shores of the river.

Other Structures.

BARING CROSS, ARK.—The Missouri Pacific, which now operates the St. Louis, Iron Mountain & Southern as its Southern district, has appropriated $400,000 for improvements and additions to be made to its shops at this place.

CLEBURNE, TEX.—A contract has been given by the Gulf, Colorado & Santa Fe to H. D. McCoy, of this place, for adding 12 stalls to its present engine house at a cost of about $30,000.

KINGSTON, ONT.—The Grand Trunk is planning to build a large hotel at Rideau Lake, near this place.

NEWPORT, PA.—Announcement has been made by the Pennsylvania that the company will put up a new brick passenger station 25 x 65 ft. at this place.

NEW YORK, N. Y.—The Hudson & Manhattan Co. has started condemnation proceedings to secure land as a site for the terminal for its proposed tunnel, which will be situated on the west side of Church street between Cortland and Fulton streets. After the completion of its tunnel, the company expects to put up a large office building on this site 20 stories high, 200 x 250 ft., to cost approximately $3,000,000. The Hudson river tunnel loop and underground passage will be extended from the building east to Broadway, where connection will be made with the present Interborough subway line.

OKLAHOMA CITY, OKLA. T.—The Denver, Enid & Gulf terminals to be built at this place will cost about $200,000, and will be used jointly by this company, the Fort Smith & Western, and the Guthrie, Plainview & Western.

PUTNAM, CONN.—The New York, New Haven & Hartford has given a contract to William Paterson, of New Haven, for putting up a stone passenger station, 28 by 132 ft., at Putnam.

PORT HURON, MICH.—The Grand Trunk, it is said, will enlarge its car shops at this place.

ST. MARCOS, TEX.—The International & Great Northern, it is said, has decided to put up a new brick freight house and to make other improvements at this place.

SYRACUSE, N. Y.—The Delaware, Lackawanna & Western has filed a map with the County Clerk showing the proposed works which the company is to build on the land bounded by Harbor Brook, West Fayette, Magnolia and Marcellus streets. The work will cost about $100,000 and will include an engine house with 19 stalls, oil house, shops 35 x 156 ft., cinder pits, switches, and a storage house 24 ft. x 80 ft. There will be three engine tracks and six car tracks. The latter will be able to hold 42 cars for storage and repair purposes. The work will be practically a duplicate of the company's new works at Utica.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ATCHISON, TOPEKA & SANTA FE.—See Jasper & Eastern.

ATLANTIC & BIRMINGHAM.—Wright, Williams & Co., who have the contract for building a part of this road through La Grange, Ga., to Talladega, Ala., will, it is said, sublet some of the work.

BANGOR TERMINAL.—Application will be made by a company under this name in Maine for incorporation, with a capital of $36,000, to build a railroad from a connection with the Seaport Railroad between Fuller Road and Hermon Junction to a point in Bangor, a distance of about six miles. The directors include Arthur Chapin, C. D. Stanford, L. C. Tyler, and others, of Bangor.

BEAUMONT, SOUR LAKE & WESTERN.—Surveys, it is reported, have been completed by this company for its proposed extension from Sour Lake west to Houston, Tex., a distance of about 65 miles, on which construction work will be commenced shortly. This road was recently reported sold to the St. Louis & San Francisco, and later to the Colorado Southern, New Orleans & Pacific, formed to operate the several Hawley-Yoakum roads. (Aug. 11, p. 47.)

BROWNWOOD, WACO & NORTHERN.—Application will be made by a company under this name in Texas to build a railroad from Brownwood, Tex., via May and Rising Star, north for a distance of about 50 miles. The proposed road will pass through a rich fruit-growing section. The cities of Rising Star and May will give $30,000 and a right of way to the company. Brooke, Smith & Co., of Brownwood, can give particulars.

COAL BELT.—Articles of incorporation have been filed by a company under this name in Utah, with a capital of $100,000, to build a railroad from Spanish Fork, in Utah County, Utah, southeast via Spanish Fork canyon east to Tie Fork, up Indian creek over Soldier Summit, and through Emma Park, along the Brook Cliffs to the coal fields in Carbon County, a distance of 89 miles. S. B. Milner is President, and G. E. Jenkins, Secretary.

COLORADO SOUTHERN, NEW ORLEANS & PACIFIC.—See Beaumont, Sour Lake & Western.

DELAWARE & EASTERN.—Contracts, it is reported, have been let by this company to John R. Lee, of Paterson, N. J., and to John F. Dolan, of Elizabeth, N. J., for a 25-mile section of its proposed road near Arkville, N. Y. Sub-contracts may shortly be let from the New York office, 5 Nassau street. (March 31, p. 101.)

DENVER & RIO GRANDE.—General Manager A. C. Ridgway of this road announces the opening, Sept. 22, of its new line from Durango, Colorado, to Farmington, New Mexico, which will be known as the Farmington branch.

ELDORADO & WESSON.—Charter has been granted a company under this name in Arkansas with a capital of $50,000 to build a railroad from Eldorado, in Union County, southwest to Wesson, a distance of about 10 miles. Incorporators include C. V. Edgar, A. B. Banks, J. R. Eakin, and others.

GOTHENBERG & NORTHERN.—Incorporation has been granted a company under this name in Nebraska, with a capital of $500,000, to build a railroad from Gothenberg, Neb., on the Union Pacific, northwest to Gandy, a distance of about 40 miles. Incorporators include W. D. Griffith, H. L. Williams, J. H. Kelly, and others.

GREEN BAY, OSHKOSH, MADISON & SOUTHWESTERN.—This company, which is building a line from Madison, Wis., north to North Crandon, a distance of about 200 miles, has plans ready to begin construction work and surveys are in progress near Shawano, Galesburg, Crandon and Bear Creek. Charles H. Hartley is General Superintendent, with office at Oshkosh. (August 18, p. 54.)

INDIANAPOLIS, CRAWFORDSVILLE & WESTERN TRACTION.—Bids are wanted by this company for grading and track laying on the first section of its proposed line from Indianapolis, northwest to Crawfordsville, Ind., a distance of 42 miles. Work is to be commenced soon. W. D. Ball, First National Bank Building, Chicago, Ill., is the engineer in charge of the work.

JASPER & EASTERN (A. T. & S. F.)—The route of this extension of the Gulf, Beaumont & Kansas City has been changed, it is said, to run southeast to Oakville, La., on the Kansas City, Watkins & Gulf, instead of building it to Alexandria, La. (See Construction Record.)

LAKE SUPERIOR & SOUTHERN.—A company has been granted a charter under this name in Michigan with a capital of $75,000 to build a railroad from Huron Bay, in Baraga County, southwest via Lake Michigamme, thence south through Marquette and Iron Counties to the Wisconsin State line, a distance of about 85 miles. The proposed road will run within 35 miles of the copper country and across the iron range. The company owns 30,000 acres of rich timber land and two large docks at Huron Bay, one of which is equipped for handling ore. The officers are: M. C. Phillips, of Oshkosh, President; R. B. Brunson, Ishpeming, Vice-President; W. K. Ridout, Treasurer, and J. O. Maxey, of Marquette, Secretary.

MISSISSIPPI & ALABAMA.—This company, recently incorporated, it is said, has surveys completed for its line. The proposed route is from a point near Corinth, Miss., south through Alcorn, Prentiss, Tishomingo and Itawamba Counties, approximately 80 miles. J. T. Savage, Edward Mayes and others, of Jackson, Miss., are interested.

MISSOURI PACIFIC.—Contracts have been given by this company to C. D. Smith & Co., of Memphis, and to Scott & Sons, of St. Louis, for double tracking 25 miles on its Southern district (formerly the St. Louis, Iron Mountain & Southern). The main line is to be double tracked seven miles north and eight miles south of Little Rock, and ten miles north of Texarkana. The work south of Little Rock will be heavy, necessitating the removal of about 50,000

cu. yds. of rock and about 500,000 cu. yds. of earth. A contract has also been given to Smith & Co. for making yards and other betterment work at Paragould and Helena, Ark., and other places. The work includes a yard at Lexa.

New York & Jersey.—This company announces the completion of the second one of its twin tunnels under the Hudson river, from the foot of Morton street, Manhattan, New York, to the foot of Fifteenth street, Jersey City. There is much additional work yet to be done, including an extension from the eastern end in the Borough of Manhattan, northeast to Thirty-fourth street and Sixth ave. The tunnels will probably not be placed in operation until May, 1907.

North Mississippi & Bay Springs.—Application has been made in Mississippi by a company under this name for a charter to build a railroad from Burnsville in Tishomingo County south to the Itawamba County line, a distance of about 30 miles. Incorporators include F. J. Ozanne, E. B. Causey and others, all of Memphis, Tenn.

Ohio & Marshall.—This company has filed plans for its proposed road through Ohio and Marshall Counties, W. Va. The road will run from Wheeling, east of the tracks of the Baltimore & Ohio, east through Mount de Chantal, along the creek to Elm Grove, thence up Big Wheeling, over to Ten-Mile creek, and through Viola to Waynesburg, Pa., about 40 miles. J. V. Thompson, of Uniontown, who is building a road from that place west to Waynesburg, and who owns large coal fields in that section, is interested in the company. (June 16, p. 199.)

Philadelphia & Reading.—Surveys have been under way for the past four months by this company for a railroad to supersede a line with two heavy grades between Pottsville and Shamokin. The plan provides for a road to leave the Schuylkill river at Schuylkill Haven and to use the Minehill branch via Cresson, West Wood Junction and Middle Creek, a suburb of Tremont. A tunnel will have to be built from Middle Creek to the North river, but it will be only half as long as the tunnels heretofore planned in the vicinity of Minersville. West from this tunnel the line would pass through Valley View and Hegins, and run thence via Klingerstown to the Susquehanna river. This would give a route from Clinton to Sunbury, 15 or 20 miles shorter than the present.

Philadelphia Rapid Transit.—This company will at once begin to lay track in the Market street subway.

Sacramento & Lake Tahoe.—Articles of incorporation have been filed by this company in California, with a capital stock of $7,500,000. The incorporators are: Chas. Wesley Reed, W. S. Graham, Leo Alexander, Thos. H. Nicholls, Jas. H. Swift, T. O. Sadler, E. F. Haas, John A. Black and H. G. Raybould.

St. Louis & Northeastern Traction.—The East St. Louis City Council has granted a franchise to this company which is a branch of the McKinley syndicate of electric road that will enter the city from the northeast.

St. Louis, El Reno & Western.—This company, which operates a line from Guthrie, Okla. T., southwest 42 miles to El Reno, is planning to build an extension from its southern terminus. Surveys are being made from that point through Canadian, Caddo and Kiowa Counties.

St. Louis, Vandalia, Terre Haute & Eastern Traction.—A mortgage has been filed by this company for $6,000,000 with the Chicago Title & Trust Co., and a certificate of incorporation filed in Illinois showing capital of $1,000,000. The company intends to connect St. Louis with Terre Haute by an electric road and has leased the right of way from the latter place to the Illinois state line. It is also stated that the company has secured the right of way from St. Louis to Effingham. Construction work is to be commenced at the Terre Haute end shortly. The directors include: Peter Chase, of Decatur; Lewis H. Bissell, Effingham; C. W. Mills, H. J. Wanner and W. B. Baldwin, Chicago. W. B. Wanner is Secretary, 119 LaSalle street, Chicago.

Seaboard Air Line.—An officer writes that this company will let contracts about the 10th inst. for building an extension of the Tallahassee South-Eastern from Wacissa, Fla., southeast to Perry, about 80 miles. The maximum grades will be .2 per cent., with a curvature of 3 degrees.

South & Western.—An officer writes that this proposed road will be built from the coal fields of southwest Virginia, in Wise, Dickinson and Buchanan Counties, south through Virginia, Tennessee and North Carolina to connections in South Carolina with the Southern, the Seaboard Air Line and the Atlantic Coast Line, a total distance of 300 miles of main line. Thirty locating parties are now in the field and the company will be ready to let contracts within a month. The maximum grades southbound will be 26 ft. to the mile. There will be a number of bridges. George L. Carter is President, and G. A. Kent, Chief Engineer, Bristol, Va. (Sept. 22, p. 96.)

South Carolina Roads.—Announcement has been made by Dr. W. Gill Wylie, President of the Southern Power Co., of Chester, S. C., that this company will build a railroad from Harmony, S. C., on the Seaboard Air Line, southeast to Camden, a distance of about 60 miles. Connection will be made at Fort Lawn with the line running to the company's works at Catawba Falls. Surveys are to be started at once and the cost of the work will be about $600,000.

Spartanburg & Northern.—A charter has been granted a company under this name in South Carolina to build a railroad from Spartanburg, S. C., north to Rutherfordton, N. C., a distance of about 50 miles, where connection will be made with the Seaboard Air Line and the Southern. The directors are: J. C. Cleveland, R. K. Caran and George W. Nichols, of Spartanburg.

Texas Roads.—Application has been made by a company in Texas to build a railroad from Dayton, in Liberty County, to the oil fields, a distance of about eight miles. M. Eastham, R. A. Grear, T. H. Bass and R. Silverman, all of Beaumont, are the incorporators.

Wabash & Rochester Traction.—Bids are being asked by this company for the completion of roadbed and track from Wabash, Ind., northwest to Rochester, a distance of 30 miles. The original line has been shortened and straightened, and new franchises have been granted in the various towns through which the road will pass. R. S. Vivian, 107 Dearborn street, Chicago, Ill., has charge of the work.

RAILROAD CORPORATION NEWS.

Canada Atlantic.—See Grand Trunk, below.

Chicago & Eastern Illinois.—Redmond & Co. and J. & W. Seligman & Co., New York, are offering at 96 $5,000,000 refunding and improvement mortgage 4 per cent. gold bonds of 1955. This is part of an authorized issue of $50,000,000, of which $5,000,000 are outstanding, $34,626,000 reserved to retire bonds issued and to be issued under prior liens, and $15,374,000 to be issued for other purposes.

The railroad company has sold to Blair & Co., New York, $2,500,000 4½ per cent. equipment bonds, series E, payable in 20 semi-annual installments of $125,000 each.

Consolidated (N. Y., N. H. & H. electric lines).—This company has bought the Hartford Street Railway, the stock of which it has controlled for several months, for $2,850,000. The Hartford Street Railway, operating 92 miles of line in and about Hartford, Conn., has $1,000,000 capital stock outstanding, and a funded debt of $2,960,000.

Grand Trunk.—This company took over the operation of the Canada Atlantic on October 1. (See also p. 109.)

New York, Ontario & Western.—At the annual meeting of the stockholders, the proposed leases of the Port Jervis, Monticello & Summitville; the Ellenville & Kingston, and the Pecksport Connecting railroads were approved. (August 25, p. 54.)

Pennsylvania Company.—The Pennsylvania Co., controlling the Pennsylvania Lines West of Pittsburg and Erie, has authorized an issue of $20,000,000 new stock, making its total stock $60,000,000. The Pennsylvania Railroad Company, the Pennsylvania Company's sole shareholder, takes the entire new issue, paying for it with part of the proceeds of the recent sale of $100,000,000 3½ per cent. convertible bonds. The money goes toward paying the $50,000,000 of notes due October 1. (April 8, 1904, p. 282.)

The Pennsylvania Company has sold to New York bankers $2,000,000 first-mortgage 4 per cent. gold bonds of 1943 of the Ohio Connecting Railway. The Ohio Connecting Railway owns the bridge over the Ohio river at Birmingham, Pa.

Quebec Southern.—Sealed bids will be received by the Registrar of the Exchequer Court of Canada until November 2 for the purchase of this road, which has 144 miles of track and has been in the hands of a receiver since March 21, 1904.

Reidsville & Southeastern.—This road has been bought by George D. Mackay, of the New York banking firm of Mackay & Co. The Reidsville & Southeastern is 16 miles long, running from Reidsville, Pa., to Glennville. The project for connecting it with the Darien & Western at Ludowici, Pa., by 25 miles of construction has been blocked, because of suits instituted to decide which company should do the building. Mr. Mackay also owns the Darien & Western, and this new purchase will solve these difficulties. An extension is being built from Reidsville to Vidalia, on the Macon, Dublin & Savannah.

Wheeling & Lake Erie.—The stockholders have authorized the abandonment of the proposed issue of $50,000,000 bonds and the substitution therefor of $35,000,000 4 per cent. 50-year bonds, the smaller amount being deemed sufficient to meet all present requirements. (May 5, p. 152.)

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

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VOL. XXXIX, No. 15. FRIDAY, OCTOBER 13, 1905.

The criticisms made in these columns of forced violations of the law by public officers, and of the proposition to entrust rate making to the Interstate Commerce Commission, should not be misunderstood to mean that government control of rates is not desirable. It is Government's right, and, when necessary, it is its duty. It seems to us that a strict enforcement of the present laws would be for the benefit of the public and of the railroads to such a degree that we should properly do this much before enacting new laws. Perhaps it is trite to again say that the interests of the public and of the railroads are identical. Three years ago in his message to Congress President Roosevelt said:

> "It must not be forgotten that our railways are the arteries through which the commercial lifeblood of this nation flows. Nothing could be more foolish than the enactment of legislation which would unnecessarily interfere with the development and operation of these commercial agencies."

This is broad-minded and statesmanlike. A candid expression of a kind that we have learned to expect from this President of great qualities, who is, we believe deservedly, the most popular man in the world. But no one is perfect, and the legislation upon which he seems determined is not at all consistent with his own principles. His attention should be called to the needs of the railroads, which are surely in this one respect exactly in accord with the interests of the public. These needs are (1) protection from each other. They could protect themselves from each other by means of traffic agreements or by pooling, but both of these methods have been declared unlawful, and therefore they need the protection of the law. (2) Protection from the shippers. Freight rates are now largely made by the shippers, and the big shippers get rates at the expense of the small shippers. The law is not enforced. Because of this non-enforcement of the law, the railroads are so suspicious of each other that they are quick to suspect rebates given by another. For example, a large shipper at a competitive point demands a lower rate than that given to others. It is refused by all competitors. Then the large shipper concentrates his shipments on one line, paying, of course, the full rate. The other companies soon look upon this as conclusive evidence that that line is cutting the rates, and they feel bound, in order to protect their stockholders, to give the large shipper a lower rate and get their share of the business. Nothing in the proposed legislation meets the needs. It is rather that which the President has expressly condemned; namely, legislation "which would unnecessarily interfere with the development and operation" of the railroads.

"Instructions have been posted on several divisions of the Pennsylvania and will probably be made effective on the entire system east of Pittsburg, that the practice of exchange of signals by the enginemen and firemen, which has long been customary and is generally observed by all engine crews, though not strictly enforced, shall hereafter be compulsory. This is said to be the direct outcome of the recent accident at Paoli. Riding with any careful engine crew one observes that if the engineman sees the signal first he calls out "white," "green" or "red," as the case may be, and this is repeated by the fireman; and *vice versa* if the signal is on the left-hand side. The new instructions are that the engine crews shall be scrupulously careful thus to call out the signals and this will be done, except in the obviously impossible case when the fireman is firing."

It is desirable that such an order be issued and much more desirable that the superintendent who issues it shall take pains to learn how fully it can be carried out. The theory of oral communication between engineman and fireman is favored by many railroad officers, but of the results in practice we know little. The "obviously impossible" proviso, when the fireman is busy, deters many from trying to enforce such a rule, and it is commonly left to the fireman and the engineman to decide when it is and when it is not impossible for the fireman to look for a signal and "holler" its indication to the engineman. Observations made two years ago on the Pennsylvania Lines West of Pittsburg give us some facts to work on. A competent inspector rode in the cab, and using a stop-watch, showed that on some engines the feeding of the fire—counting from the time the operation was begun until the fireman had returned to his seat—occupied only 10 per cent. of the fireman's time, while on the largest engines it took no more than 19 per cent. If these figures hold true generally, which from personal observation—without a stop-watch—seems to admit of some doubt, it should be possible for any fireman to observe and communicate to the engineman the position of all signals, except in yards with very frequent signal indications. The cases in which, if at all, it is most probable that the observed percentages of the time spent in actual firing are too small, are on heavy grades, which the inspector found affected the fireman's labor quite as much as the size of the engine. On up grades, however, the danger of accident from over-running a signal is less than anywhere else, and if necessary the fireman's check on the signals might here be dispensed with. Unless, in fact, it can be fairly proved on any given division that the fireman is never obliged to attend so continuously to his fire that he cannot take a look ahead on approaching a signal—and at night, when the glare of the fire temporarily blinds his eyes, he has a pretty strong argument against serving as lookout man—we must either trust to his judgment and discretion or else give specific instructions concerning every signal. As firemen's minds and consciences must in most cases have long and patient training before their judgment can be trusted in a matter of this kind, the logical way out of the dilemma is to make a list of all the signals on the run and order that certain ones shall be duly sighted, every trip, even if the fire has to be, for the moment, neglected. This is what firemen do now, at some signals, where the fire duty is not pressing. The question is, can such a rule be prescribed concerning all signals, or nearly all? We hope so, but most important, let inspection show whether

or not such an order can be faithfully carried out in all cases at all times. Accidents are rarely caused by the lack of good rules, but nearly always by a sporadic failure to obey a rule.

Progress in the design of solid or ballasted bridge floors is exemplified to good advantage in the track elevation work in Chicago. Most of the advance that has been made has resulted from the efforts of the engineers to produce a solid bridge floor design that would combine satisfactorily the qualities of water-tightness, preservation of the metal work, and noiselessness. With one or two exceptions, all of the designs used up to the present employ steel as the foundation for the floor. Upon this, in square-trough, V-section, plate, or some such form, have been placed preservative and water-proofing materials, over which the ballast is spread. But a bridge engineer concerned in this track elevation work recently made the statement that, with one exception, he knew of no case where absolute water-tightness had been secured with any of the designs in use. The amount of deterioration of the steel is not yet known, sufficient time not having elapsed to demonstrate the effects of deteriorating influences; but in cases where re-protection has been necessary the work has been costly. The use of reinforced concrete for solid bridge floors is new, but experience with it during the past two or three years has been quite satisfactory and encouraging. An experimental floor of this sort was tried by the Chicago & Western Indiana in its track elevation in the latter part of 1903. It stood the test of the following winter so well that it was adopted as standard. Other floors put in since that time have shown the same good results. The plan is simple, corrugated steel bars being placed on top of the I-beams and about 4 in. of wet concrete applied. The concrete projects below the tops of the I-beams about 1 in. and a concrete fillet is formed next to the girder web. These reinforced concrete floors have been treated to the same protective covering as was given to this road's previous design of timber deck, but this has been merely a precautionary measure to make their tightness doubly sure. The Chicago, Milwaukee & St. Paul and the Burlington have designs quite similar to this. The former began its use in its 1905 track elevation work, and the Burlington put in some floors a year ago. For a girder and I-beam floor construction it seems about the simplest and most satisfactory system that has been tried. It seems that in some form of reinforced concrete design is to be found the solution of the problem that has been bothering for so long, for in it are contained the qualities that hitherto have been sought. As indicative of the present trend in that direction, one Chicago road, which has been a pioneer in reinforced concrete designs, contemplates a radical departure in its bridges for some track elevation lately begun. Instead of a girder and I-beam floor construction, massive reinforced concrete slabs will be used. The only steel work will be the columns and cross girders for supporting the decks, and it is understood that the estimate shows a considerable saving over steel construction.

THE CORONER'S PRIVATE CAR AND THE PACKER'S PRIVATE FREIGHT TRAIN.

A Coroner in a railroad shop town, where heavy material and machinery are handled by many men, and lives are occasionally lost by somebody's carelessness, has, if he is an advanced thinker, a power to compel violations of the Interstate Commerce law quite like that of the President of the United States. It is like although it is less. A railroad officer gives exact details, with the assurance that it is simply typical, of the following incident:

A Coroner wrote asking for passes for himself and family for a summer vacation trip. The clerk, who received the letter, did not answer it but filed it alphabetically where similar foolish applications were kept. The Coroner wrote another letter in a tone to which the experienced clerk was not unaccustomed, and this was put with the General Manager's morning mail. The General Manager replied at once, enclosing the passes asked for, expressing his pleasure in doing so and asking the Coroner to address him personally for any future "courtesies."

The gap between the President of the United States and a village Coroner is considerable, but it is filled with a long line of officers, national, state and municipal, with varying degrees of power to compel violations of the Interstate Commerce law. In these columns two weeks ago a somewhat detailed account was given of the President's demand for a special train, free, when he traveled with his friends. This has been re-published or discussed by all of the important daily newspapers in this country as if it were an entirely new condition, instead of one which has prevailed for a generation, and is familiar to every railroad president and manager. Too frequently, the conclusion is drawn that Congress should appropriate $25,000 or $50,000 for a presidential train, its equipment and the cost of hauling it. The New York *Sun* says:

> "In the matter of his travels it cannot but be humiliating to him, and ought to be to the United States, that he must approach railroad companies in *forma pauperis* and billet himself upon them. He and they are forced to a violation of the Interstate Commerce law, which appears to be the chief palladium, and only genuine aegis of liberty in these days. This must be disagreeable to him, and even the railroad managers, black as their professional naggers and pursuers admit them to be, may have their feelings and at least some penumbra of rights. The president of a railroad has his private car. The President of the United States should travel at the expense of the United States, and not at that of the railroads. The President's train should be composed of all steel cars, solid, practically indestructible. It should contain, at any rate, a combination baggage car, dining car, a sleeping car, and a private parlor or saloon car, with an observation end. Its fittings and decorations should be in the best taste, in other words, not exactly according to Pullmanian canon. The President should be safe and comfortable; and even the difficult boon of occasional privacy should not be denied him."

This proposed remedy for a great evil would be amusing if it were not so pitiful. Would any one seriously propose to stop felony by singling out one felon and paying him such a salary as would put him out of reach of temptation to commit felony? There are congressmen, governors, legislators, mayors, justices of the peace, assessors, office holders and politicians generally, and coroners—don't forget the coroners—nearly all of whom have powers, and many of whom exercise them, to get exceptional favors from railroads. The coroner's function in this connection is peculiarly fascinating. With only a slight bias, his investigation of a fatal accident may make many thousand dollars—sometimes hundreds of thousands—difference in the amount for which the company is mulcted. He may so deal with the dead as to make a snap for the living. Ghastly and bland he looks forward to a cheap summer trip—perhaps with his friend the undertaker as his guest if the company "treats him right."

The logic of the proposed remedy is inevitable. If the President's lawlessness in the past is to be condoned by cash payments in the future; if Congress supports his "unalterable determination"—repeated last week as a reply to his exposure—to control railroad rates charged to all except himself; if the present righteous law for treating all alike continues to be enforced only sporadically; if favored rebaters and solicitors of rebates are to be let alone—then by all means let the remedy be extended to others than the President. Let each Senator and member of Congress and others all along down to the coroner have a special car. This courtesy to the coroner will appeal to every one. When all this is done, when with clean hands and a disinfected conscience the officers of Government make a new law giving the Interstate Commerce Commission authority to make changes in rates, effective until over-ruled by the courts (and every important decision of this Commission thus far appealed has been reversed by the Supreme Court), what is the result? We have simply shifted this responsibility from those who are vitally interested in making transportation cheap to a committee of inexperienced and not necessarily able men.

Assuming that all railroad officers are morally bad and that all Interstate Commerce Commissioners are good, nevertheless the officer has professional reputation at stake. Unless he serves the community well, builds up the industries along his line and helps so far as he can to make his customers well-to-do, and so increase his company's earnings, he loses his job. His profession is one in which this talent is in high demand and better paid than in almost any other profession. If five men, political appointees, can do this work better and serve the public better than thousands of picked men trained for the work, then the proposition may be justified, but it would have no effect in checking present rebates and discriminations forced on the railroads.

The logical sequence of the remedy proposed would seem to be an extension of the original one: Let not only the President and the coroner have his private car, but extend the courtesy of free freight trains to the packer and the pipe line owner—to every man and corporation who has power to dictate to the railroads.

Anomalous Electric Railroad Returns

Heretofore we have had occasion to point out infirmities of the Railroad Commission of Connecticut, especially in its attitude toward the electric railroad companies of the State. That commission is a "political" body and but recently has been made entirely partisan in its composition. Vested with large powers over electric railroads, particularly as to capitalization, it has never exercised them. It has had no definite policy. Its returns have been meagre and defective, and there have been serious and palpable flaws affecting even the simple computations; and its recommendations to the

State legislature have been few and its influence on law-making almost nothing. As a result one finds in the State—counting in a few gas and electric light companies merged with the electric railroads—the enormous capitalization in stock and debt of $86,612 a mile as stated in the last annual Commission report, and a variation of cost ranging between $15,000 and $165,000 a mile. In the case of many of the lines all the capital stock is water and a considerable percentage of the bonds also, the roads having been built on the "bond and bonus" plan.

By contrast, if we turn to the sister State of Massachusetts, we find a commonwealth not only careful and advanced in electric railroad law-making but a Commission very strict in the practical application of the statutes. We discover there a Commission nonpolitical in character, with definite policies, alert, progressive, making very full and informative returns, so potent in statute making that its recommendations have almost the force of law and enforcing the rule of replacement value in capitalization. To use its own words in its last annual report: "In no case has there been an issue of stock or bonds in excess of the fair cost of the railroad property." One of the most vivid indices of the result is an electric railroad capitalization of Massachusetts in stock and debt of but $50,295 per mile, compared with $86,612 in Connecticut, as stated—and this in a commonwealth that includes the City of Boston, with its great suburban population and a commonwealth the cost of whose urban railroads in actual and honest cost of construction undoubtedly far exceeds the same cost in Connecticut.

What would be the natural inference from such a contrast of financial, statutory and administrative conditions? In Connecticut we should, of course, infer receiverships, staggering railroad corporations, fiscal decrepitude; in Massachusetts, prosperity, dividends for stockholders and a strong tendency toward new construction. In fact, on the face of the returns, one finds almost exactly the reverse. Last year out of 74 operating roads in Massachusetts 30 failed to earn expenses and fixed charges; only 25 paid dividends and only 14 earned them during the year, and but 10 companies have properly earned and paid a dividend, during the last five years, of at least 5 per cent. Five companies have been in the hands of receivers. In Connecticut, on the other hand, the returns since the beginning of the trolley "boom" some 12 years ago show that, out of some 35 original lines only one has gone through bankruptcy or defaulted in interest—and in that case because of an unprofitable contract with a large connecting and urban company rather than from actual lack of earning power. In the formal Connecticut list last year 26 companies appeared in the report of the commission of the State. Of these several were practically consolidated with larger companies and the 26 are, in fact, reduced now by consolidations to some 13. But allowing for dividends hidden by consolidations last year 10 out of the 26 paid dividends as compared with 25 out of 74 in Massachusetts. Last year in Massachusetts main track mileage increased but about 34 miles and in Connecticut about 58 miles.

Returns so anomalous and which, on their superficial face, seem to set at naught all theories of fiscal sanity in electric railroad development require explanation. In the list of qualifying facts stands first the comparative ratio of consolidation. This has been fairly extensive in Massachusetts—where, for example, there were five consolidations during the last year covered by the State Commission's report. But, if we may use the phrase, it "cuts no ice" compared with the extent of consolidation in Connecticut. In the latter state, as explained, some 35 originally independent companies, have now been reduced to about a dozen. One large corporation, itself controlled by the United Gas Improvement Company of Philadelphia, owns the trolley systems of the cities of Norwalk, South Norwalk, Bridgeport, Derby, Ansonia, Waterbury and New Britain. Another corporation controlled by the New Haven (steam) railroad company has the systems of Stamford, New Haven, Hartford, Meriden, Middletown, Willimantic, Norwich, New London and Putnam. On a rough estimate three-quarters of the trolley plants and a larger ratio of earning capacity of the Connecticut electric railroads are vested in two corporations. Just as in the history of steam roads; the result has been protective, fiscally speaking. Earnings of strong trolley roads have "washed" the earnings of weak ones, the big corporation standing as a kind of guarantee for all. The infirm trolley, which has found asylum in the swift consolidation of Connecticut, has gone to the receiver under the progress of slower consolidation in the sister State. The same rule holds true as to the disparity in construction. The large controlling company, at a time when immediate and profitable trolley territory seems exhausted has the money for extensions—the returns of which may be somewhat remote—at a time when private capital shrinks from the venture. The big proprietary company, in other words, often sees opportunity with keener, more far-sighted and wider vision.

Again, as against the paradox of the returns, is to be set the presumptively better public service of the average electric railroad in a State where the railroad commission is efficient and public complaints are thrust home. Thus the cost of operation in Connecticut is $4,797 per mile. In Massachusetts it rises to $7,145 per mile; and, even allowing for high cost of operation in Boston, the disparity remains great enough to be significant. Making a similar comparison in somewhat different form Massachusetts electric railroads return a percentage of operating expense to gross earnings of 70.20 per cent.; those of Connecticut 66.75 per cent. The latter is probably the better test of the two as it leaves in the form of a ratio the larger earnings of the Boston lines as connoted with larger operating cost. How equipment, including particularly character and condition of cars, compares in the two States would undoubtedly shed further light on the anomaly of the returns if it could be figured out. All that can be said is that it is one of the obscure factors to be reckoned in with the presumptions in favor of the commonwealth that enforces the more sharply the principles of public necessity and convenience.

Finally another feature of the Massachusetts returns both absolute and comparative is to be noted. It has been a State in which, with its great centralities of population east, say, of Worcester, electric enterprise has been peculiarly alluring and its territorial opportunities at first were very large. As against the initial rush into those enterprises a decade ago a strong railroad commission could do a good deal but it could not do everything. It could enforce honest capitalization and check the inflation tactics of syndicates inside the State as well as outside; it could not make over fiscal human nature and prevent rash enterprises of men who were willing to risk their money. The outcome shows that there were a good many investors of that stamp who would have been much more numerous and the results correspondingly disastrous if the policy of the Commission had been lax. When history is thus added to an exceptional local situation and both are joined with other facts which we have enumerated the anomaly in the returns of two divergent New England States, ceases to be such; and, incidentally, we get some fresh hints as to the importance of looking deeper than the face of railroad Commission returns.

Chicago & Alton.

The Chicago & Alton is one of the oldest and best known of the Chicago granger railroads. It has the rare distinction of not having passed through receivership or foreclosure since the civil war. In 1862, the Chicago & Alton Railroad purchased at foreclosure sale the St. Louis, Alton & Chicago, which then ran from Chicago to St. Louis. When, in 1879, a Kansas City connection was acquired, the property was considered complete by its owners, who refused to participate in the mania for extension in the late '80s, when granger railroads in particular were building thousands of miles of new line. When 1893, with its railroad disasters, came, this policy seemed to have been a successful one. The companies which had been concerned most largely in extending their lines (some of them had added 2,000 miles in a year) fell into financial difficulties. The Atchison and the Union Pacific went into bankruptcy. The Missouri Pacific was saved only by personal advances of its directors, "the Gould pride," as it has been called. The St. Paul, the North-Western, the Burlington, and others, suspended or reduced dividends. All this time the Chicago & Alton continued uninterruptedly its 8 per cent. dividends on its common and preferred shares.

It was only in the revival of business after 1896, following the depression, that the failure of the non-expansion policy came into sight. In 1899, when most roads were very greatly increasing their gross earnings over the lean years, the gross earnings of the Chicago & Alton were less than in 1893, 1892, 1891, 1888, 1885 or 1882. Net earnings were also less than in a number of previous years. These were vital facts for the management to face and required prompt action, which was taken in the reduction of dividends on the two classes of stock to 7 per cent. in June, 1897. This was at a time when western crops were exceptionally good and when neighboring and competing roads were enjoying heavy gains in income and enlarging their dividends. The result, in fact, of the period of expansion in railroad building was proved to be that many companies on which the Chicago & Alton had formerly greatly depended for traffic had extended their lines into, or beyond, its territory, and, with their new through lines, were carrying a large amount of traffic which the Alton had formerly obtained. In 1898 more than 80 per cent. of the freight and 90 per cent. of the Alton's passenger traffic was local traffic. Not only was the management brought face to face with this disquieting state of affairs, but nearby and direct competition was threatened. The St. Louis, Peoria & Northern, a local railroad in southern Illinois which had several times been bankrupt, and was in itself of little consequence, passed into the hands of new owners whose object was by north and south extensions to create a new through line between Chicago and St. Louis. Such a line, if built, would have paralleled and seriously hurt the Chicago & Alton.

At this time, when so many difficulties surrounded this old, conservative and very successful property, the Harriman interests bought the St. Louis, Peoria & Northern and at the same time, through an offer to the Chicago & Alton stockholders, in 1899 secured control of the Chicago & Alton itself, paying $200 a share for the preferred and $175 a share for the common stock. The road was re-

organized by them as the Chicago & Alton *Railway*, with a very large increase of capitalization and, incidentally, very large profits to themselves. This was done by substituting for small issues of high grade securities, large amounts of consequently less valuable stock. The new company leased the old Chicago and Alton, on whose stock it yearly receives 7 per cent. dividends amounting to $1,525,622, and bought the 57 miles from Springfield to Peoria, Ill., of the St. Louis, Peoria & Northern, its threatened competitor. Before the reorganization, on 844 miles of line there was $22,230,600 capital stock and $18,583,850 bonds, or $26,340 stock and $22,020 bonds per mile, a total capitalization of $48,360 per mile. At present, on 915 miles of line there is $39,086,800 capital stock ($42,719 per mile), and $27,000,000 funded debt ($29,508 per mile), a total capitalization of something over $72,000 per mile.

The present report is the fifth of the new company, and shows the increases in various departments since the reorganization. Gross earnings have steadily increased from $7,155,961 ($8,483 per mile) in 1899 to $11,797,314 ($12,893 per mile) last year. Net earnings have similarly increased from $2,992,384 ($3,584 per mile) in 1899 to $4,194,650 ($4,584 per mile) in 1905.

The first move of the new owners was to begin the entire reconstruction of the property, so as to make it most efficient from an operating standpoint. In pursuit of this policy the operating ratio has been increased from 58 per cent. in 1899 to 66 per cent. last year. The extent of the expenditures for improvements may be judged in another way from the following tables which show the expenditures for the two classes of maintenance per mile for 1899, the year in which the road was leased, and since that time. During this period there has been an increase of only 70 miles in the length of road operated.

Maintenance, per mile.

Way and structures.		Equipment.	
Year.	Amount.	Year.	Amount.
1899	$824	1899	$658
1900	1,031	1900	711
1901	1,206	1901	956
1902	1,043	1902	1,113
1903	1,325	1903	1,301
1904	1,580	1904	1,345
1905	1,600	1905	1,460

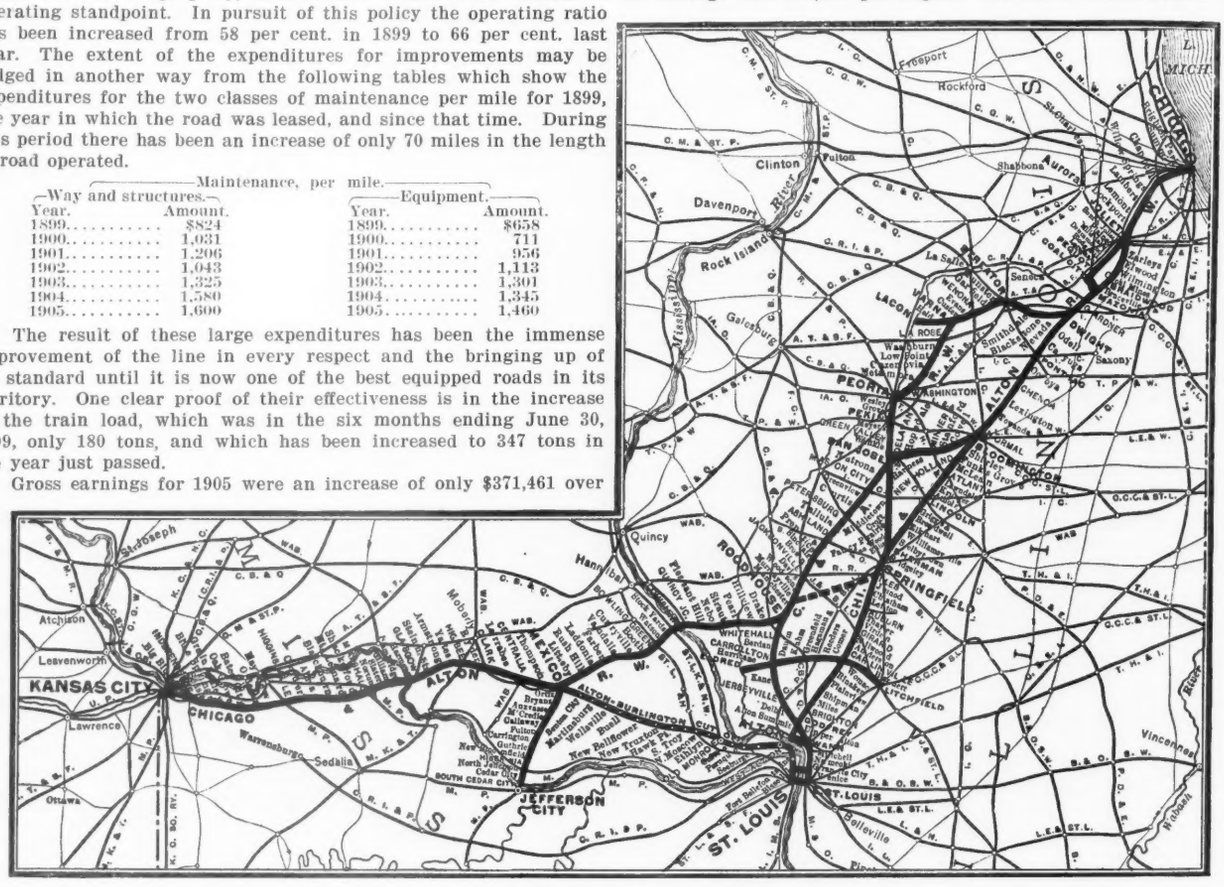
The result of these large expenditures has been the immense improvement of the line in every respect and the bringing up of its standard until it is now one of the best equipped roads in its territory. One clear proof of their effectiveness is in the increase in the train load, which was in the six months ending June 30, 1899, only 180 tons, and which has been increased to 347 tons in the year just passed.

Gross earnings for 1905 were an increase of only $371,461 over 1904, though in 1904 there was an increase in gross of considerably over a million above the 1903 figure. The freight revenue last year decreased $486,950, and had it not been for the increase in passenger revenue caused by the St. Louis Exposition and the very favorable situation of the Chicago & Alton in connection therewith, the unbroken record of increases in earnings would have been broken. Passenger earnings made up for the decrease in freight revenue by an increase of $833,618, or 25 per cent.

Changes in the expense account can be taken account of only in a general way, as detailed figures for expenses are not given. Maintenance of way cost $1,463,689 against $1,446,010 in 1904. There was an increase of 102 per cent. in expenditures for ballast, a decrease of 66 per cent. in money spent for spikes and fastenings, and an increase of 60 per cent. in expenditures on bridges and culverts. Maintenance of equipment took $1,336,211 of the total expenses, an increase of $105,448, or 9 per cent. over 1904. Repairs of locomotives increased $52,121, or 10 per cent., and repairs of freight cars, $37,244, or 9 per cent. Conducting transportation cost $4,469,846, or $4,884 per mile of road, against $4,559,731, or $4,982 per mile of road, last year. In 1904 conducting transportation was 40 per cent. and last year 38 per cent. of the total earnings.

The train load increased 11 tons, or 3 per cent. over 1904, being 347 tons in 1905 and 336 tons in 1904. The number of tons of freight carried one mile per mile of road was 1,103,069, a decrease of 97,785 tons, or 8 per cent. from 1904. The number of passengers carried one mile per mile of road was 264,337, an increase of 76,325, or 41 per cent. over 1904. There was an increase in the average number of passengers per train mile of 15, or 26 per cent., and in the average distance passengers were carried of 19 miles, or 35 per cent. The average passenger traveled 73 miles against 54 miles in 1904, while the average ton of freight was carried 153 miles against 165 miles in 1904, a decrease of 12 miles, or 7 per cent. The revenue per passenger increased from 1.06 cents to 1.27 cents, or 20 per cent., at the same time that the revenue per passenger mile decreased from 1.95 cents to 1.73 cents, or 11 per cent. With the increase of 25 per cent. in total passenger earnings, the passenger car mileage increased only 16 per cent., showing that trains were better filled.

The number of passengers handled by the Chicago & Alton during the seven months of the Exposition was 2,355,307, of which 857,158 passengers were carried to and from St. Louis. As an interesting comparison, the aggregate business handled by the old Chicago & Alton in 1893 in connection with the World's Fair at Chicago was 530,458 passengers. President Felton points with gratification to the fact that the enormous passenger movement to and from St. Louis was handled without injury to a single passenger.



Chicago & Alton.

No statement of classified tonnage is given. Freight traffic earnings are given in some detail and show decreases in every class, except in lumber and other forest products, earnings from which increased $26,500 (6.7 per cent.) following an increase of $30,650 (8.4 per cent.) in 1904, and miscellaneous merchandise, earnings from which increased $42,850 (3.55 per cent.) following an increase of $104,500 (9.47 per cent.) in 1904. Some of the decreases are not at all surprising in view of large increases in 1904 over the preceding year. Earnings from live stock, for instance, decreased $36,000 (5.2 per cent.) after an increase of nearly $200,000 (40 per cent.) in 1904. Similarly earnings from flour and other mill products fell off about $40,000 (15 per cent.) last year after an increase of $122,000 (85.5 per cent.) in 1904. The largest actual and proportionate decrease during the year was in grain earnings which fell off $240,000, or 22 per cent. Earnings from coal and other mine products at the same time decreased $213,000, or 12 per cent.

There was expended for betterments during the year $434,646, but no hint is given as to whether this was charged to income or to capital account. There were no extraordinary improvements, but

the continuous betterment of the line was carried on. Counting in last year's installations, electric block signals are now in use on 351 miles of main track. The largest single expenditure was one of $124,664 for terminal yards. Fifty-seven miles of second main track are now under construction, and at the same time grades are being reduced to secure a 3.3 per cent. grade between the Illinois coal fields and Chicago. Of the 781 miles of main line, 692 miles are laid with 80-lb. rails and 529 miles ballasted with stone, the latter clear evidence, in comparison with other western roads, of the fine condition of the line.

From a local line with decreasing earnings in prosperous times the new Alton has been brought as a Harriman road to be a strong through line which has yearly since the reorganization increased earnings along with operating efficiency. An interesting development of the past year has been the buying of a half interest in the road by the Chicago, Rock Island & Pacific, the present board including at least four Rock Island directors.

The more important statistics of operation follow:

	1905.	1904.
Mileage worked	915	915
Freight earnings	$6,958,927	$7,445,877
Passenger earnings	4,185,561	3,251,943
Gross earnings	11,797,314	11,425,853
Maint. way and structures	1,463,689	1,446,010
Maint. of equipment	1,336,211	1,230,762
Conducting transportation	4,469,846	4,559,731
General expenses	332,917	288,097
Operating expenses	7,602,663	7,524,600
Net earnings	4,194,651	3,901,253
Other income	1,794,139	1,766,273
Surplus for the year	151,407	123,908

Missouri, Kansas & Texas.

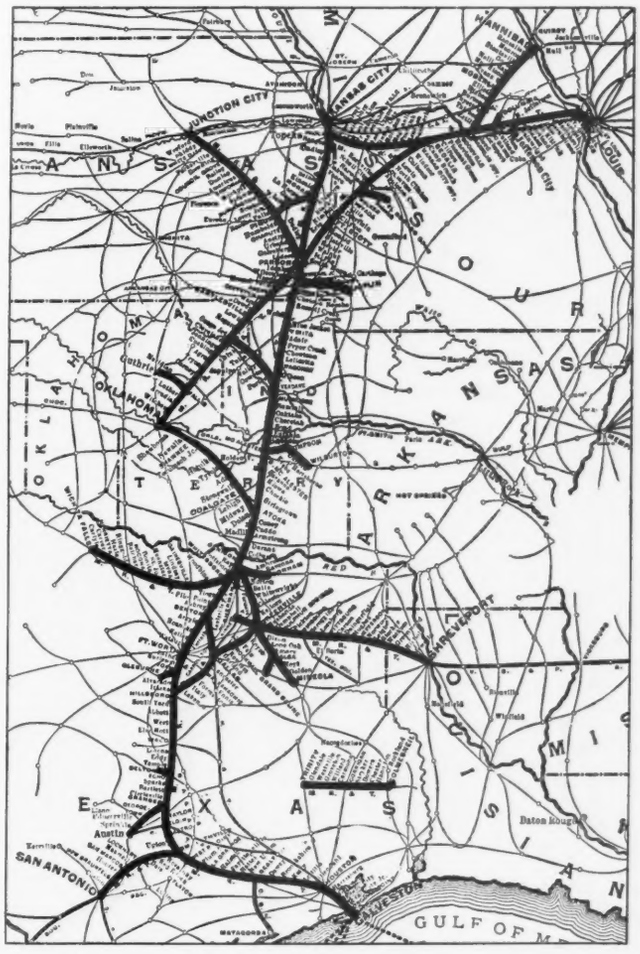
The Missouri, Kansas & Texas runs from St. Louis to Kansas City and from St. Louis and Kansas City south to San Antonio and Galveston, Tex., with various branches and feeders extending into Kansas, Missouri, Oklahoma, Indian Territory and Texas, and to Shreveport, La., where connection is made with the Queen & Crescent (Southern). It is an independent road, and is therefore handicapped in obtaining its share of competitive traffic, for most other roads in this territory are allied with some stronger interest. In 1881 the Missouri, Kansas & Texas acquired the International & Great Northern by exchange of stock and was itself in the same year merged with the Missouri Pacific, which indirectly guaranteed its bonds and was to operate the road on a long lease. Interest, however, was defaulted in 1888, the lease was cancelled and receivers for the M., K. & T. appointed, the International & Great Northern becoming again a separate organization, although control of its stock was sold to the Missouri Pacific. In 1900 the Missouri, Kansas & Texas was finally reorganized without foreclosure.

At the time the road went into the hands of receivers in 1888 it had about 1,600 miles of line, with terminals at no important point. It was made up of six separate and disconnected parts, the longest running from Hannibal, Mo., to Dallas and Jefferson, Tex. Important terminals and much construction were necessary to bring the road into anything like effective shape. More than this, like most lines at this time, particularly in the southwest, there was great need of very complete improvements. The weak point in the reorganization was the fact that no funds were provided for this necessary rehabilitation of the road.

Since 1900, however, as will be seen from the accompanying map, the Missouri, Kansas & Texas has been extended and unified so that it has only one still unconnected line and now reaches important terminals. At the same time there has been much improvement of the line. By 1901 there were 2,480 miles in operation, reaching St. Louis, Kansas City, Houston, Galveston and Shreveport. During that period of ten years more than $4,000,000 had been expended on bridge maintenance and renewal. In the next year important extensions were made into Indian and Oklahoma Territories to counteract extensions of the Rock Island, Santa Fe and Frisco into the same territory. One of the most serious problems which the new management has had to face has been the competitive extension of rival companies. In 1893 the Rock Island extended its line into Texas. In 1897 the Kansas City, Pittsburg & Gulf (Kansas City Southern), which proved to be an irresponsible and dangerous competitor, was completed to Port Arthur, Tex. Later the Southern Pacific extensions and acquisitions in Texas were made. The St. Louis & San Francisco extended its lines to Fort Worth and secured control of the Fort Worth & Rio Grande, thus creating an extensive system of competitive lines through northern and southwestern Texas. The Choctaw, Oklahoma & Gulf, which as an independent line was the most important ally of the Missouri, Kansas & Texas in coal traffic, was acquired by the Rock Island. These are only examples of extensions and acquisitions by rival lines on M., K. & T. territory.

With all these difficulties to face it is remarkable that the present management should have been successful in building up gross earnings from $9,750,564 in 1892, the first year of their operation of the road, ($7,922,444 in 1889 under the receivers) to $20,041,095 in 1905. Not only is this a remarkable increase, but during the past year alone has come a very large part of it, gross earnings in 1904 being $17,766,595, which makes the increase for the past year $2,274,500. This favorable showing had the effect of raising the quotation on the preferred stock of the company, on which no dividends have ever been paid, but which is entitled to 4 per cent., if earned, from 30 about a year ago to 70 in September, continued and definite rumors of payments on the preferred shares accounting for the rise in price.

All reports that dividends will soon be paid should be set at rest by the statement of Chairman Rouse in the report, who gives the position of the management on this question. The defective plan of reorganization, he says, has made it necessary to apply to the improvement of the property all surplus revenue, and to use the company's credit in paying for necessary equipment, on which notes amounting to $4,591,536 are now outstanding. With a profit and loss surplus of only $940,891 and a provision in all existing bond issues that they shall be available only for new expenditures, it is clear that no distribution on the stock can be thought of until these equipment notes are met and cancelled. Until this is done, unless there should be an exceptional increase of revenue, the present state of affairs is likely to continue, and the preferred stockholders must, apparently, possess their souls in patience until the southwest has developed enough and the road has been improved enough so that earnings can be paid out instead of being turned back into the road in improvements which are made necessary in order to put the road in shape to cope with the sharp competition which it must face.



Missouri, Kansas and Texas.

In 1892, at the end of the first year under the present management, with an operated mileage of 1,674 miles, gross earnings were $9,750,564, and net earnings, $2,369,996. In 1905, gross earnings were $20,041,095, an increase of $10,290,591, or 106 per cent., and net earnings, $5,113,375, an increase of $2,733,379, or 115 per cent. Passenger earnings during these 13 years have increased 164 per cent. and freight earnings 93 per cent. In view of the large amount of new mileage built in recent years, it is characteristic of the road's recent prosperity that gross earnings per mile of road have increased from $5,825 in 1892 to $6,586 in 1905, and net earnings per mile of road from $1,416 in 1892 to $1,677 in 1905.

Operating expenses were $14,568,436 last year against $12,659,-

470 in 1904, an increase of $1,908,966. This ate up most of the increase in gross earnings, but more was spent on maintenance than in the preceding year. Maintenance of way cost $3,643,201 in 1905 against $2,690,226 in 1904, an increase from $933 per mile of road in 1904 to $1,197 per mile of road in 1905. Maintenance of equipment, which took $1,925,195 in 1905 against $1,613,969 in 1904, similarly increased from $560 to $633 per mile of road. Conducting transportation, on the other hand, shows an increase gratifyingly small in comparison with the large increase in business moved. Conducting transportation cost $8,114,061 in 1905 and $7,521,054 in 1904, an increase of $593,000 or less than 8 per cent. against an increase of over 12 per cent. in gross earnings.

There were 1,273,145,491 tons of freight moved one mile, an increase of 43,317,926 ton miles over 1904. The average revenue per ton mile also increased from 1.065 cents in 1904 to 1.110 cents in 1905. The train load increased from 199 tons in 1904 to 205 tons in 1905. In this respect much remains to be accomplished. One step soon to be taken is the reduction of grades between McAlester, Ind. T., and the Red river (Indian Territory-Texas boundary) where the largest volume of traffic is handled.

There were 238,600,721 passengers carried one mile, an increase of 66,537,663 passenger miles. The average revenue per passenger mile decreased considerably from 2.210 cents in 1904 to 2.069 cents in 1905. At the same time the average distance which each passenger traveled increased from 58 miles to 66 miles.

Of the tonnage carried, 10 per cent. was lumber and 18 per cent. manufactures and merchandise, the latter an encouraging increase from 16 per cent. in 1904 and probably responsible for the higher average freight rate received. Coal furnished 31 per cent. of the total traffic against 33 per cent. in 1904. Live stock furnished 7 per cent. of the total.

Operating expenses were largely increased by the severity of the winter in the southwest, and what President Finney refers to "as the annual interference with traffic and losses by floods in Kansas." In connection with the floods, 6.7 miles of track have been raised, water openings strengthened and additional bridges built.

Through funds supplied from the refunding first mortgage, the company has bought at Kansas City, 58 acres for use as an outer yard as well as land in the business district for a freight house. The same source is also to provide for the construction of extensive shops at Parsons, Kan., to cost about $1,000,000.

Mr. Rouse calls attention to the fact that in Kansas and Missouri there has been during the past year drastic legislation enlarging the powers of the railroad commissions of those states and placing in their hands the rate making power within the state boundaries. Should the similar agitation which is spreading into Oklahoma result in rate legislation there in the near future, practically the whole territory covered by the Missouri, Kansas & Texas would be subject to restrictive rate control by political bodies. This, Mr. Rouse believes, can hardly fail to prove detrimental to the property, as it amounts to surrendering to the patrons of the road the power to fix the compensation for service rendered. The probable injurious results of these grants of power are much lessened by the business activity which at present prevails; but there is a menace in the situation, especially in view of any discussion of a distribution of the comparatively small surplus which the company now has. As an indication of the general antagonism to railroads throughout this part of the country, the total number of claims filed against the M., K. & T. during the year amounted to 9,069, a large number of which, according to Mr. Rouse, are frivolous and would not be tolerated in more conservative communities.

The record of the road since reorganization is a distinctly gratifying one. With the present policy of steadily investing large amounts of earnings in the improvement of the road continued and the development, as yet only begun, of the southwestern country, the time should soon come when the Missouri, Kansas & Texas shall have greatly increased both in value and operating efficiency.

The principal statistics of operation follow:

	1905.	1904.
Mileage worked	3,043	2,884
Freight earnings	$14,134,335	$13,102,910
Passenger earnings	4,935,592	3,802,202
Gross earnings	20,041,095	17,766,595
Maint. way and structures	3,643,201	2,690,226
Maint. of equipment	1,925,195	1,613,969
Conducting transportation.	8,114,061	7,521,054
General expenses	885,979	834,222
Operating expenses	14,568,436	12,659,470
Net earnings	5,472,659	5,107,126
Other income	425,181	316,723
Surplus for the year	1,267,191	1,066,369

TRADE CATALOGUES.

Filtration Plants.—The Pittsburg Filter Manufacturing Company has issued four descriptive pamphlets covering municipal and railroad water softening and filtration plants. These are entitled "Municipal Filtration Plants"; "Pure Soft Water for Boilers and Railroad Water Stations"; "Gravity Filters, Pressure Filters and Water Softening Plants," and "A Bacteriological Report of the Municipal Mechanical Filtration Plant at Danville, Va.," by a director of the laboratory of the city water department, giving the results of ten tests of filters installed by the company. The pamphlet on pure soft water gives various photographs of the company's plants, including several railroad water softening plants, with a list of the railroads and cities which use them.

Pneumatic Tools.—The Independent Pneumatic Tool Co., Chicago, sends an illustrated folder descriptive of the "Thor" piston air drills, reversible wood-boring machines, and pneumatic chipping, calking and riveting hammers.

CONTRIBUTIONS

Cast-Iron Car Wheel Specifications and Tests.

Bellevue, Pa., October 2, 1905.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In general, specifications are intended to aid the seller to understand definitely the wants of the purchaser and also to enable the latter to know beyond a doubt that he is getting what he has bargained for. The plan adopted by a number of the principal railroads of this country in buying equipment supplies resolves itself into one of systematic penalties against all errors of process and practice so that the tests often stand more as a means of rejection than inspection. Perhaps no product of manufacture has suffered more from such unwise policy than the cast-iron wheel. This repressive policy on the part of some of the railroads has been responsible to a great extent for the inability of a large number of cast-iron car wheels to stand up under the increased capacity cars, and for the desire of the cast-iron car wheel makers to do away with all guarantees as to service. In other words, the railroads have created for themselves a boomerang.

If large shippers should refuse to pay for several train loads of freight because one part of one car of freight was not delivered in good order as agreed, how long could the railroads continue to spend large sums on the development of their equipment and service? Yet this is the trend of the policy adopted by some of the railroads against the cast-iron car wheel makers. If one wheel out of 103 is not just up to the letter of the specifications the inspector is supposed to reject the whole lot and consider them as so much scrap when as a matter of fact and judgment 102 of them would be ideal as to strength and service. This exercise of power defeats its own purpose.

There is talk of increasing the severity of the tests as though the wheels were to be purchased for their ability to stand certain tests instead of given service conditions. This is only another step in the policy of repression. There is a limit to the tests beyond which there will be no benefit. Thousands of wheels that would not meet the letter of many of the specifications now in vogue have stood and are standing the most severe service conditions required. Increasing the severity of the tests, with the consequent increased opportunity for penalties by rejection, will still further retard the natural development of the cast-iron car wheel to keep pace with the increased demands upon it in the way of service, by reducing the profits to a point where improvements in quality of materials and processes will be untenable.

Improvements in the cast-iron car wheel in design, strength and wearing qualities have nearly always kept abreast of the demands along these lines. This will continue to be the case in even greater measure than heretofore, if the railroads will but extend to the manufacturers more co-operation and justice. Looking this question squarely in the face the natural query is, "Who should get up the specifications?" Plainly and honestly, not only those who know a wheel from the shopman's standpoint, or the inspector's reports, or the master mechanic's experience, or the mechanical engineer's theories, but also those who are actually engaged in its manufacture.

The specifications for the purchase and tests of cast-iron car wheels should be drawn up by a board or committee composed of an equal number of railroad representatives and cast-iron car wheel makers. This board, by a two-thirds vote on each proposition, should have absolute authority over every word and line of the specifications for the roads so represented. If the larger railroad systems enter into such an arrangement a uniform practice can be established that will accrue to their mutual benefit. The inspectors should be instructed to accept all that is good and reject only that which is unsafe and bad.

Having chosen specifications that amply safeguard the interests of a railroad without injustice to the manufacturers, the railroads should see to it that the purchasing departments encourage those makers furnishing wheels of the best quality.

In conclusion I will say that a low chilled wheel is not neces-

sarily a strong one nor a high chilled wheel a weak one. Also that a "poor" iron with proper foundry conditions will produce a better wheel than the very best high grade charcoal irons will make with bad foundry practice. J. W. HENDERSON.

Normal Danger vs. Normal Clear.

BY C. H. PLATT.

[Late General Superintendent, New York, New Haven & Hartford; chairman Safety Appliance Committee, American Railway Association; reporter on automatic signals to the International Railway Congress at Washington.]

No one would think of constructing, or dare to construct, a signal mechanism on the normal clear principle. Considerable expense is incurred to add counterweights and to supply the necessary power to lift them every time a clear indication is desired. The practice of going to further expense to hold them in that position about 20 hours out of every 24, giving them every opportunity to stick or freeze in the clear position, is indefensible, if another and safer way has been provided.

Where there are interlocking plants, with signals installed and operated on the normal danger principle, it is very inconsistent to install adjoining signals on the normal clear principle. The practical result often is a starting signal at danger, the first block signal (likely in plain sight) at clear, furnishing engineers a good excuse for overlooking the "starter" and running their trains into danger.

Where switch indicators, or bells, are used to give a danger indication when a train is approaching, the general interlocking principle should certainly govern. If the main line signal is clear, the siding must be blocked. These are conflicting routes, and the signal indication for one should always be the reverse of the other. This principle is strictly observed in the normal danger plan in all cases and at all times, while under the normal clear both the main route and siding indications are normally clear.

Surely there should be good and sufficient reasons for going contrary to principle, disregarding consistency, and ignoring danger for installing signals on the normal clear basis. What are the controlling reasons given by those who advocate that practice? The following includes the important, if not all, of the published reasons in articles on the subject:

a. A false clear indication is as liable to be given under one system as the other.

b. The normal danger system uses more line wire and contact points than the normal clear.

c. The signals on double track roads can be more easily inspected from the rear of the train if the normal clear is used.

d. The fact that there is a larger number of signals installed on the normal clear system shows that many believe in that practice.

e. The normal danger system employs the normal clear circuits, plus additional complications, and is more expensive to install (a repetition in part of "*b*").

f. The cost of operation under the normal danger system is only a trifle less than under the normal clear.

Accepting these as final there is in them nothing to warrant ignoring principle, consistency and danger, as above outlined, but many of these will not stand the test of a close examination.

"*a.* False clear indications as liable under one system as the other." This is not a reason, if true; is it true? Signals stick and freeze, unfortunate, but true. This freezing is not confined to the mechanical parts controlling the semaphore arm; a more fruitful source is the sticking by frost, or otherwise, of the slot arms and clutch magnets, and in such cases signals are nearly always held in their normal positions. There is no time for freezing in the temporary position of two to five minutes at a time. If they freeze in the normal clear position they do all that mechanical arrangement can do to provide the conditions for a rear end collision. Under the most favorable outcome they increase the number of false clear indications.

"*b.* Additional line wire and contact points." This is true to this extent: one line wire between the home and the distant signal, and one clearing relay, if compared with the so-called wireless circuit for the normal clear. If the wire circuit normal clear is used the amount of line wire is the same unless switch indicators or bells are used in conjunction with the block signals, in which case more line wire is required for the normal clear than the normal danger. It is almost universally true that parts are added to any electric or mechanical device to accomplish results not before accomplished, or to give added protection, but no one at this late day will claim that the additions required for the normal danger cannot be safely and regularly operated with the utmost efficiency.

"*c.* More easily inspected from the rear of a train." This refers to the opposite track only, and under conditions of traffic favorable to such so-called "inspections." No up-to-date management would place any reliance upon such a superficial inspection. But calling it an inspection for argument's sake, what can one find if he happens to find anything? Simply a failure to clear. This is on the side of safety. On the other hand, what can one find under exactly the same conditions if signals are installed under the normal danger system? He finds the failure, if any, to protect, and may prevent a rear-end collision.

"*d.* Larger number of signals installed on the normal clear system." This statement is true if time is taken into consideration, but it is not a good reason. It is as true that at one time all signals were installed on the normal clear principle. But the premises are rapidly changing. The normal clear had 20 years without competition before the normal danger was evolved, and it was then brought out to do away with the inherent defects and dangers of the original system; some railroads have changed, others not as yet.

"*e.* Cost of installation greater." Generally speaking, this is true, but the saving in operation and maintenance covers the extra expense in a year or two, and during the lifetime (as a whole) of the signals, the normal danger is less expensive.

"*f.* Cost of operation only a trifle less," is really an argument for the normal danger, and calls for no comment, except to say that the saving is not "trifling," and that no necessary expense is unwarranted, especially to retain an element of danger.

In addition to what has already been said, the normal danger is correct in *theory*. Lines are blocked for the protection of traffic. Theoretically, then, the normal condition of the section should be "blocked," and a signal should only be cleared when a train is approaching, providing the block is clear—not left normally unblocked.

Conditions have arisen when something occurred to endanger trains when the signal showed clear. It is far better in principle and safer to hold the signal at danger until a clear indication is required and can be safely given, than it is to restore it to danger perhaps after the engineer has seen it in the clear position.

The normal danger is more efficient for reasons already stated, and because high resistance magnetic coils are unnecessary. It lessens the dangers of lightning and residual magnetism, and decreases the liability of failure on account of chilled batteries.

While signals are installed principally for controlling trains in one direction, they give valuable information for other purposes if installed on the normal danger principle. Under the normal clear a train may approach at any time without notice by changing the position of the signal; under the normal danger the signal clears, only on the approach of a train, and the clearing relay can be placed at any desired point, so that the engineer can see it clear if so desired, or at the entrance of the block; or in the case of short blocks, at the entrance of the next block in the rear. When installed in this, the usual way, trackmen and bridgemen working in sight of a signal are always informed as to the approach of a train, and can govern their work accordingly to better advantage, and with greater safety to themselves.

On double track, engineers can be informed of the approach or non-approach of a train on the opposite track; can maintain higher speed past stations if no train is approaching, and avoid running between another train and a station if a train is approaching on the opposite track.

Persons using highways or farm crossings in sight of a signal can be governed intelligently as to the use of the crossing.

At commutation stations especially, patrons learn to notice the position of signals, and if clear, indicating a train in the block, hasten their approach to the station, and are ready on the platform to take their train promptly upon its arrival, shortening the average stop to some extent.

Automatic intermediate signals between interlocking points work in harmony with such signals if installed on the normal danger principle, without change in locking circuits, or in operating regulations.

I may have omitted some of the minor points, but the principal reasons in favor of either system are enumerated above.

Recent Bridge Work on the Nickel Plate.

BY ALBERT J. HIMES,
Bridge Engineer, N. Y., C. & St. L.

The New York, Chicago & St. Louis was built in 1882. The bridges of wood and iron erected at that time were unsuited to the present heavy traffic and their reconstruction has been in progress for about six years. It is the fixed policy of the road to pay for all improvements out of current earnings, and this work has therefore not progressed as rapidly as it might have done had the whole amount of money to be expended been available at one time. Up to the present time about 13,000 tons of new work have been erected and at the beginning of this year there yet remained to be built approximately 7,000 tons. Of this amount 1,600 tons were under contract.

Among the structures which have been or are to be replaced are four double-track viaducts, having a total length of 6,099 ft., and eight single-track viaducts, having a total length of 7,996 ft. The depth of the ravines crossed by the viaducts is generally about 100 ft. Fig. 1 shows the old viaduct at Swanville, Pa., which illustrates the style of all the old structures. They were pin-connected, king-post, and Fink trusses of 30 ft. and 60 ft. span supported by trestle towers. The old structures were generally in good condition

and the material of excellent quality. Many of them have been re-erected on the neighboring electric roads and are still doing good service.

But two of the old viaducts remain on the road, one at Painesville, Ohio, which is under contract for renewal, and one over the Cuyahoga Valley in Cleveland, a part of which has just been reconstructed. Fig. 2 shows the new viaduct at Ashtabula which is typical of all the new viaducts. They are composed generally of alternate 30 ft. and 60 ft. deck plate girder spans supported on trestle towers. The bracing of the towers is composed entirely of stiff members with riveted connections.

These viaducts have been erected upon the old masonry without interrupting traffic. This seemed to be a new problem for the bridge companies and their first attempts did not compare very favorably with their later efforts. In one case, a temporary run-around was erected of wood, and in another case a falsework was erected about 90 ft. in length along the track and moved ahead from span to span by taking it down and re-erecting. The latter method was very slow and tedious and also very expensive.

The most satisfactory method, and that which was used at Ashtabula, is to build a ground traveler to envelope the whole structure and move it along on runways placed on the bed of the valley. This method is well illustrated by Figs. 3, 4 and 5, which are reproduced from photographs of the work at Ashtabula. The girder spans were riveted up complete at one end of the viaduct and new ties placed on the span ready for rails. The spans were then run out on flat cars, lifted from the cars by the traveler, and the car run back off the structure. The track was then cut, the old span lowered to the ground and the new span lowered to place. In changing the towers, the new bents were first set up close to the old bents and when ready for the change, after lifting the old tower span from the posts, the old bents were disconnected and moved towards the center of the tower, the new bents placed in position, connected by longitudinal bracing, and the old span lowered to place on the new posts. The ends of the old 60-ft. spans adjacent to the tower were also supported by the traveler during the operation. The maximum time required to place a new tower was three hours, and to place a new span, two hours. It was very seldom that trains were delayed, and never more than two hours, the limit fixed by the contract. The total time of erection, not including the framing and removal of the traveler, was 73 days. There were about 10 trains per day running over the viaduct during working hours.

A novel method of placing the span at the west end of the structure was used, where by reason of the slope of the side of the valley, the traveler could not be moved near enough to the abutment to swing the span directly to place. A gallows frame was used to carry one end of the span, while the other end was held by the traveler.

The removal of the 170-ft. span and the erection of the 75-ft. and 80-ft. plate girder spans over the creek was a somewhat different proposition and required the use of timber towers to carry the 80-ft. span. The latter span came at about the center of the truss span and was erected first without breaking the old trusses. Portions of the steel towers at each end were erected before the span and when it became necessary to break the portals to put in the 75-ft. spans, it did not take long to make the change. When the sway bracing had been removed the old trusses were bolted directly to the new girder spans to hold them in position while taking them apart. The old piers were abandoned and will be removed.

The bridge material was manufactured by the King Bridge Co., Cleveland, Ohio, and erected for them by the Pittsburg Construction Co.

There are five drawbridges on the road, three of which have been rebuilt and one is under construction. The Cummings drawbridge over the Grand Calumet River in Chicago is a single-track riveted structure, partially continuous over the center, and has a span of 214 ft. 11 in. center to center of end bearings. The load is transmitted to the drum by means of four loading beams bearing on eight radial girders at a point such that about 12 per cent. of

Fig. 1—Typical Fink Truss Viaduct at Swanville, Pa. Built in1882. Rebuilt, 1904.

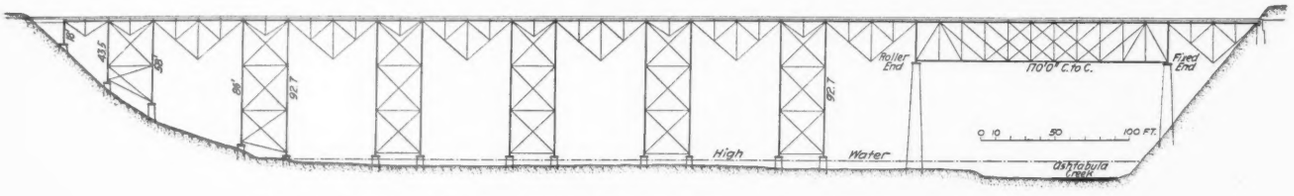


Fig. 2—Elevation of Old Ashtabula Viaduct, New York, Chicago and St. Louis.

the weight is carried on the center and 88 per cent. on the rim. The end lifting apparatus consists of a toggle arrangement such that the motion of the bearing surface is vertical. Its corners are beveled, and it operates as a wedge to bring the bridge into perfect line when driven home. The rails are connected by a sleeve rail-lock which makes the rails continuous, and they are connected with the interlocking apparatus in such a way that the rail-locks cannot be drawn until the semaphores have been set at danger. The bridge is operated by a 16 h.p. gasoline motor. The perfection of the operating machinery is shown by the fact that one man can turn the bridge by hand under favorable conditions and three men can release the support at the ends of the bridge. The total weight of the bridge is 261 tons.

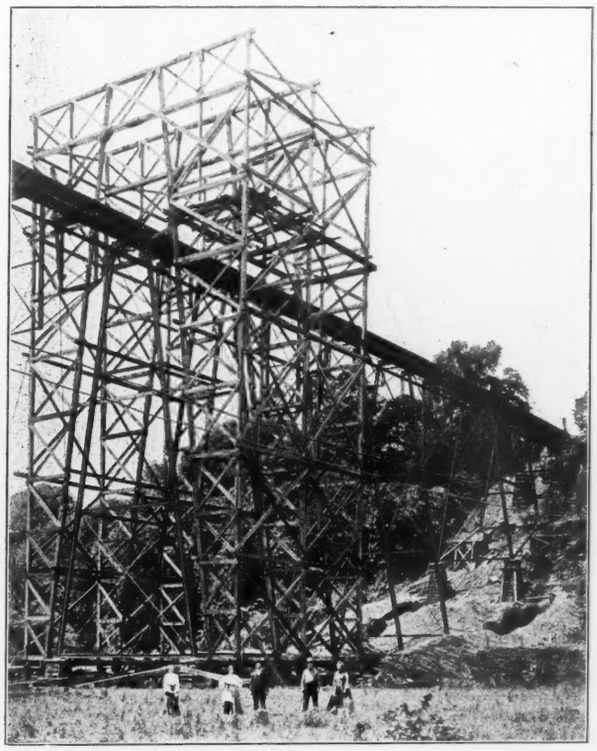


Fig. 3—Traveler Used in Erecting Ashtabula Viaduct.

The Hammond drawbridge is a double-track structure 225 ft. long, used jointly by the Erie R. R. and the N. Y., C. & St. L. Mr. M. R. Strong, Bridge Engineer of the Erie, designed the bridge, and the construction was performed under the direction of the N. Y., C. and St. L.

The Lorain drawbridge is similar in a general way to the Cummings bridge. It is operated by electricity and the load is distributed to 16 points on the drum and to the center. The latter carries 20 per cent. of the weight. The bridge weighs 604 tons and has a span of 341 ft. 4 in. center to center of end bearings. It is shown in Fig. 6.

The new bridges are being designed to carry two 136-ton locomotives, coupled, followed by 4,000 lbs. per lineal foot. The material used has an ultimate strength of between 56,000 and 64,000 lbs. per sq. in. The unit stress is 7,500 $\left(1 + \frac{\text{min}}{\text{max}}\right)$ for tension members, and all rivet holes are reamed except those in the bracing. The railroad company either prepared full detail plans before asking proposals, or else specified that the structure in question should be similar to some structure already built. In the case of the drawbridges above mentioned, the plans were prepared by the railroad company, there being none like them on the road. The mill and shop inspection was handled directly by the railroad company, that method having been found more satisfactory than turning the work over to an inspection bureau. The latter plan was tried first and then abandoned.

Three large viaducts were built by the American Bridge Co., and most of the other work, including all the drawbridges, by the King Bridge Co. The fabrication of the work by both companies was very satisfactory. Rapid and careful erection was performed by the Pittsburg Construction Co., which has sub-contracted for much of the erection from the King Bridge Co.

When by reason of a change in the span length or in the character of the bridge, new masonry has been required, it has been built entirely of concrete. Old masonry, when in bad condition, has been reinforced by concrete jackets having iron rods taken from the old bridges, embedded in the concrete to prevent a pos-

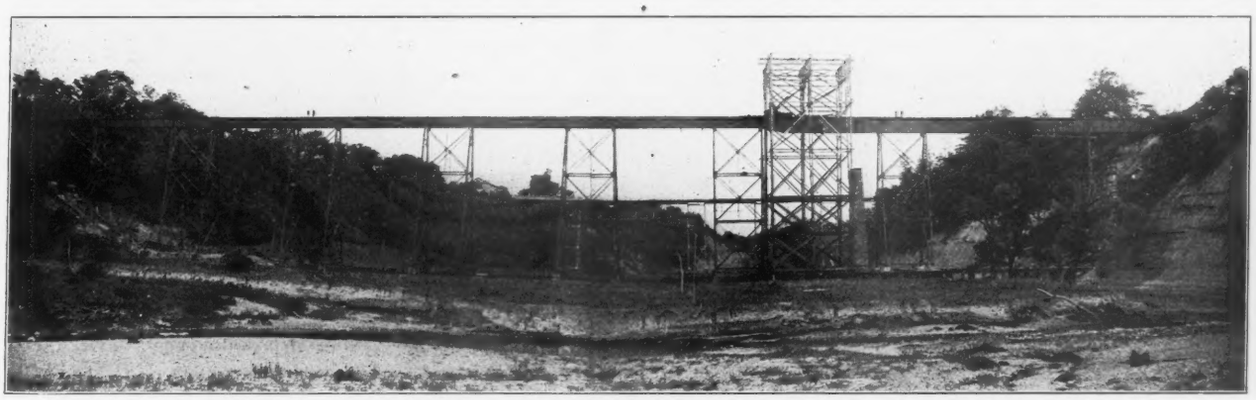


Fig. 5—New Viaduct Over Ashtabula Creek, Showing Traveler.

Fig. 4—Completed Viaduct Showing Girders and Towers.

Fig. 6—New Drawbridge at Lorain, Ohio.

sible separation of the old masonry from the new. Where changes in the height of piers and abutments have been necessary, new concrete copings of liberal thickness have been built and the whole course of concrete firmly tied together with large iron rods.

The most difficult foundations were at Lorain, where the material under the center pier and the west abutment was a soft gravelly clay which required piles. Excavation was made by means of coffer dams to a depth of about 22 ft. below water and then piles were driven in the bottom of the pit as close together as possible. The piles were not cut off but left sticking up into the concrete in an irregular form, thus avoiding the expense of a grillage and making it certain that every pile did its share of the work. It was thought best to carry the concrete down to the depth of 22 ft. in order that dredging in the channel might in no case endanger the foundation for in the case of the center pier, had the piles been unsupported for even a short space between the ground and the masonry, there would have been danger of displacement that might interfere seriously with the operation of the bridge.

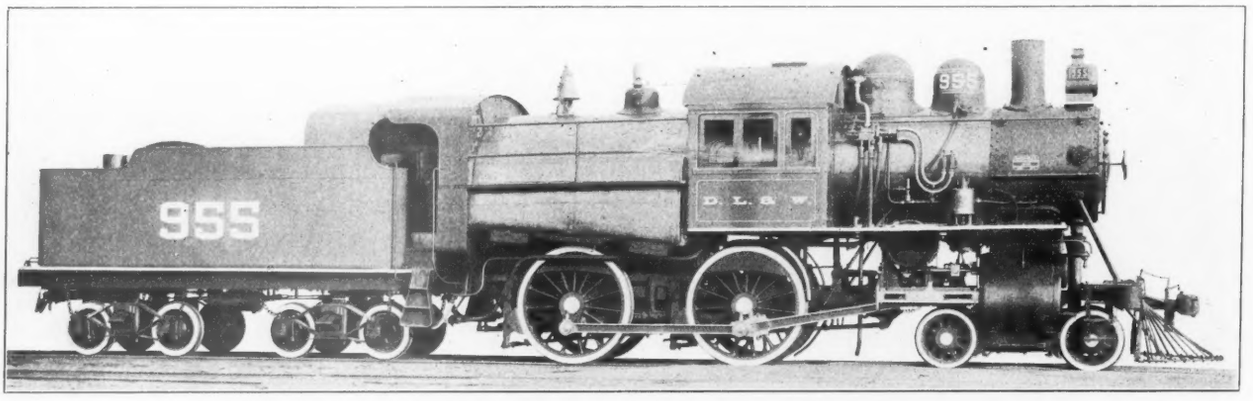
At Cummings and Hammond the foundation was a gravelly clay so hard that no piles were needed. At Cummings the new center pier was built on the location of the old pier, but having a much larger diameter, 30 ft. at top, only the outer shell, about 10 ft. thick, was carried down to the full depth of 22 ft., the center of the pier being filled with concrete right over the old foundation, which was composed of piles and a grillage. The grillage was, of course, first removed and the concrete deposited among the piles so as to secure their full bearing value.

The foundation work was all done by day labor under the direction of the railroad company's engineers. The concrete was made of Portland cement, sand and unscreened limestone in the proportion of one barrel of cement to 10½ cu. ft. of sand and 27 cu. ft. of stone. The concrete was built at an average cost of a little less than $5 per yard exclusive of the freight charges on material hauled over the company's own line.

All of the bridge renewal work on the New York, Chicago & St. Louis is being carried out under the direction of Mr. E. E. Hart, Chief Engineer.

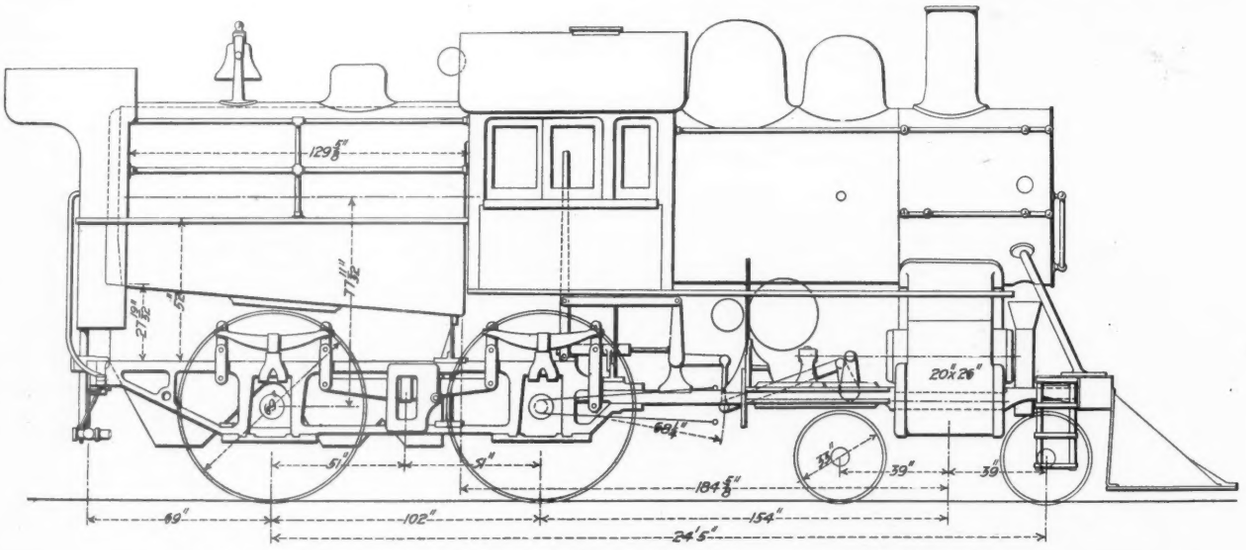
Lackawanna Locomotive with Schenectady Superheater.

The American Locomotive Co. has recently built two eight-wheeled (4-4-0) locomotives for the Delaware, Lackawanna & Western, one of which was fitted with a Schenectady or Cole superheater. The general construction of the superheater pipes and connections is the same as that already illustrated in the *Railroad Gazette* for June 9, 1905, in connection with the Pacific locomotives for the Erie. In this case there are 60 large tubes for the superheater, arranged as shown in the accompanying plan of the tubesheets, where there are 60 2½-in. holes in the back, and 60 $3^1/_{16}$-in. holes in the front tubesheet. It will be seen, too, that they occupy the upper central portion of the nest of tubes having a depth of six horizontal rows and a width of ten vertical rows, which is equivalent to somewhat more than eight horizontal and 15 vertical rows of the ordinary tube. The superheater tubes, moreover, are not staggered, but are set in straight lines, for the sake of securing a more convenient connection at the front end. As the space occupied falls well within the transverse dimensions of the tubesheet, the small tubes rise in four vertical rows on either side outside the superheater tubes, as in the case with the engine noted above. The superheater tubes naturally reduce the heating surface very materially, in this case cutting it down from 1,947.89 to 1,635.56 sq. ft.

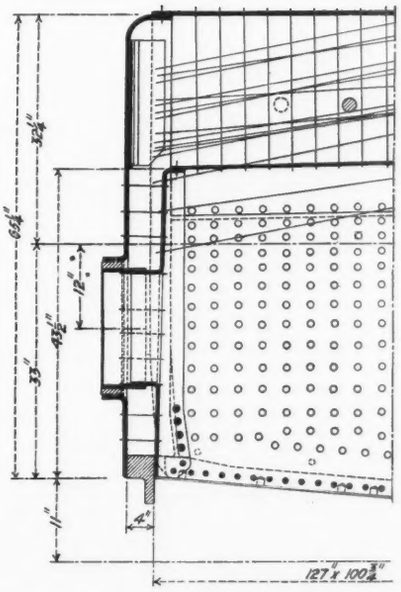


Passenger Locomotive for the D., L. & W. R. R. Fitted with Schenectady Superheater.

The boiler has the broad Wootten type of firebox, in accordance with the standard practice of the road, and this has one very wide door with across inside dimensions of 34¼ in. This was probably done in order to avoid the troubles that are apt to arise when two doors are cut in the back head. The method of cutting the door opening itself is worthy of attention. Instead of flanging the inside sheet out far enough to engage the flange of the outer sheet and rivetting the two together, the inner sheet is turned out only just far enough to rivet to a ring which, in turn, runs out to engage with the outer sheet, a heavy ring being placed between the two for stiffening. Instead of the double rivetting all round the mud ring that is common practice, the sheets have a single rivetting along the sides and ends; double rivetting being used only at the corners where leaking is most liable to occur. In fact, it



Side Elevation of 4-4-0 Locomotive with Schenectady Superheater—D., L. & W. R. R.

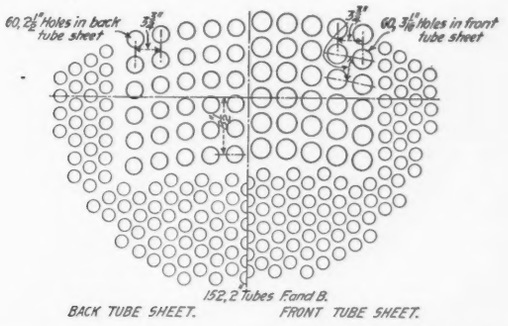


Longitudinal Section of Back End of Fire-Box Showing Door Construction—D., L. & W. Locomotive.

has been shown by long practice that double rivetting at the corners is all that is needed. In this case the shape of the mud ring is particularly well designed in order to accomplish this neatly and effectively. The firebox is carried, at both the front and back, by the buckle plates that have come to be accepted practice. The dome connection is very heavy, having a thickness of 1 in., and the opening is farther stiffened by the use of an inside plate or welt ¾ in. thick. At the firebox there is a shallow combustion chamber, and at the front the shell extends out beyond the tubesheet to take the ring connecting with the smokebox. The back course of the shell is conical with the top horizontal and the bottom sloping down to the throat sheet, thus increasing the depth of the body of water beneath the tubes where it is especially needed.

From the side elevation of the engine it will be seen that the whole of the boiler, with the exception of the smokebox, where it rests upon the saddle, is carried by buckle plates similar to those used under the firebox. Those that come beneath the shell are merely the continuance of an old practice. A noticeable feature in connection with the machinery is the use of the piston valve and the sharp angle of rise of the connection between the link block and the rocker arm. Open eccentric rods are used and the link is brought down to the level of the driving axle, while the upper end of the rocker arm is about 18 in. higher. This requires a sharp angle for the bar, but the advantages of a direct connection and an inside admission for the valve are retained.

The driver brakes are operated by two cylinders placed between the frames on a line with the guides. These cylinders are bolted to the inside of the frames and work on the upper end of a lever that multiplies the pull six to one. To the lower end of the lever a connection leads to an equalizer at the forward driver which distributes the pull to the brake-shoe levers of the two wheels, an arrangement that will be readily understood by reference to the special engraving of the driver brake rigging.

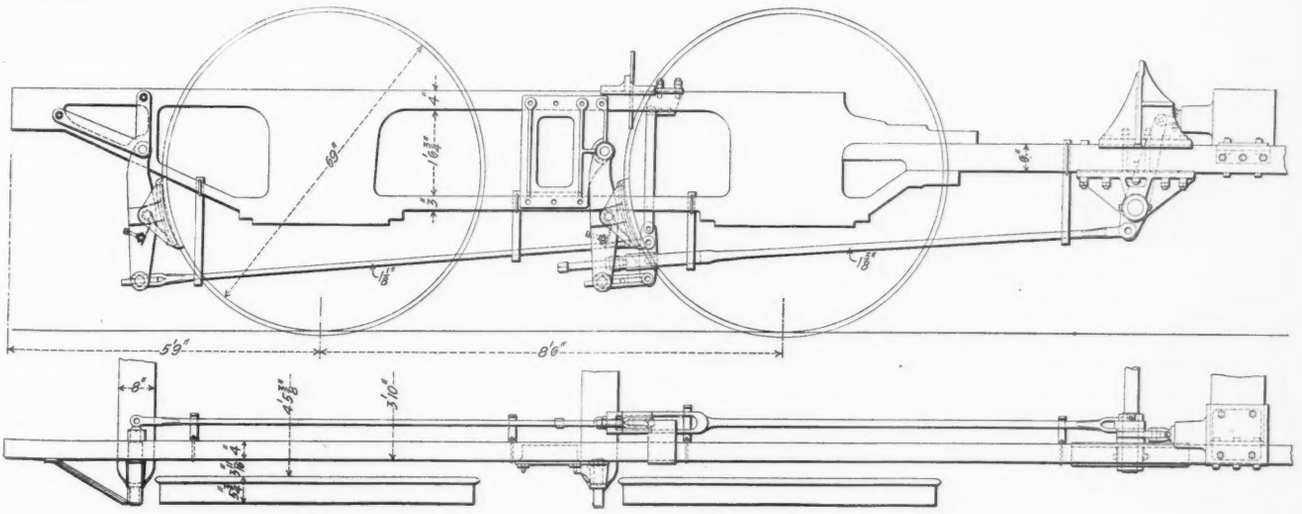


Arrangement of Tubes D., L. & W. Locomotive with Schenectady Superheater.

The following are some of the principal dimensions of these engines:

Cylinder, diameter	20 in.
Cylinder, stroke of piston	26 in.
Wheel base, driving	8 ft. 6 in.
Wheel base, total	24 " 5 "
Weight in working order, without superheater	151,200 lbs.
" in working order, with superheater	153,100 "
" on drivers, without superheater	100,000 "
" on drivers, with superheater	101,000 "
Heating surface without superheater	1,947.89 sq. ft.
" " with superheater	1,635.56 "
" " firebox, without superheater	190.8 "
" " firebox, with superheater.	191.54 "
" " total, without superheaters	2,138.69 "
" " total, with superheaters	1,827.10 "
Grate area	87.54 "
Axles, driving journals, diameter	9 in.
" " " length	13 "
" truck, " diameter	6½ "
" " " length	12 "
" tender, " diameter	5 "
" " " length	9 "
Fuel	Fine anthractie
Boiler type	Straight top
Firebox (Wootten) width	100 in.
" length	126 3/16 "
" thickness (crown, side and back sheets)	⅜ in.
Water space	4 "
Crown stays	Radial
Tubes, diameter	2 in.
" diameter, for superheater	3 "
" No. 2-in. diameter, without superheater	280
" " 2-in. " with "	152
" " 3-in. " with "	60
" length	13 ft.
Exhaust pipe, double, diameter	3¼ in.; 3⅜ in.; 3½ in.
Stack, diameter	18 in.
Stack, height above rails	15 ft.
Tender, frame	10-in. steel channel and plates
Tank capaciay, water	5,000 galls.
Tank capacity, fuel	10 tons.
Valve, type	Piston
" travel, .5½ in.; lap, .1 in.; exhaust clearance, 1/16 in.; lead, 1/16 in.	
Wheels, driving, diameter	69 "
" engine truck, diameter	33 "
" tender truck, diameter	33 "
Tractive power	23,710 lbs.

Cast-steel is used for the journal boxes and driving wheel centers, and the engine is equipped with the Westinghouse high-speed brake.



Driver Brake Rigging of 4-4-0 Locomotive—D., L. & W. R. R.

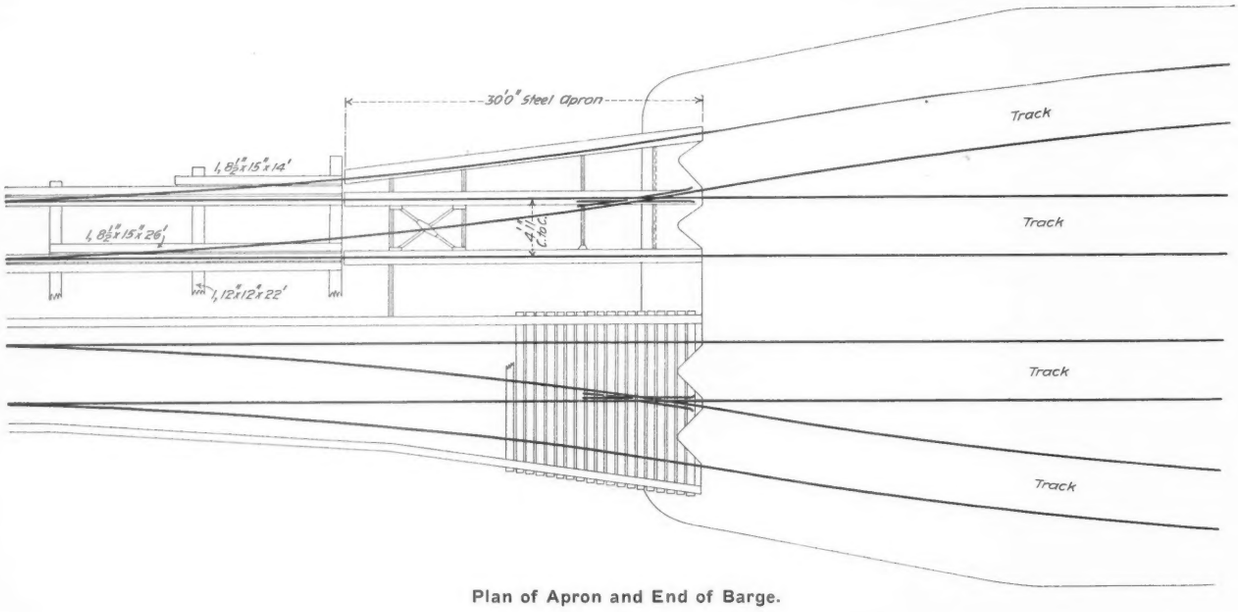
East Ivory Car Ferry of the Missouri Pacific.

With the exception of the Illinois Division, which runs from East St. Louis south to Thebes, Ill., the Missouri Pacific lines are all west of the Mississippi river and have St. Louis as their eastern and northern terminus. The Southern District lines, formerly known as the St. Louis, Iron Mountain & Southern, during the last five years have been gradually extended by new construction and purchase so that there are now what are practically two complete parallel lines from Louisiana north to St. Louis, one running from 50 to 100 miles west of the Mississippi and the other following closely along its banks. The road now known as the Illinois Division was built about three years ago by outside interests and sold to the Missouri Pacific on its completion. It forms the northern link in the new line parallel to the main line of the St. Louis, Iron Mountain & Southern and takes the place of a road on the west bank of the river, a route which had been previously surveyed and considered in connection with this plan for a parallel road into St. Louis. The Illinois line offered much more favorable grades than the route in Missouri, which ran through rough undeveloped country, and at the same time taps the excellent coal fields of southern Illinois as well as offering an outlet for the tremendous corn crops grown in that region. So despite the fact that its utilization as a part of the Missouri Pacific's north and south line involved two crossings of the Mississippi river it presented a more favorable route than the one originally surveyed on the Missouri side. At the south end of the line connection is made with the rest of the system over the Thebes bridge to Gray's Ferry, Mo. At the north end the freight terminals are in East St. Louis and passenger trains run into the St. Louis Terminal Station over the Ead's Bridge. The Terminal Railroad Association terminals in St. Louis and East St. Louis are often badly congested and the charges for transfer across the river are high so that it was thought necessary to provide some other means of transfer for freight operated exclusively by and for the railroad company. Plans were accordingly made soon after the purchase of the Illinois Division for building the necessary inclines and cradles on both sides of the river for a car ferry to operate about six miles below the Eads Bridge at East Ivory, Ill.

The design of a suitable incline and bridge involved difficulties not met with in lake and tidewater ferries. The banks at this point are low and provision must be made for changes in the stage of water of as much as 20 ft. as against 8 ft. or 10 ft. in most tidal waters. The usual form of floating bridge and apron was, of course, out of the question and an incline trestle and moving cradle was substituted. The details of the trestle and cradle are shown in the drawings.

The main line of the Illinois Division is about a mile back from the river bank and a double track embankment was built across the bottoms to the end of the incline, which is approached on a 10-deg. curve. The trestle work begins about 100 ft. out from the high water mark on the bank and extends down into the river on a 4 per cent. and 3.45 per cent. grade for a distance of about 900 ft. It consists of bents of eight piles each spaced 11 ft. 9 in. and 11 ft. center to center surmounted by four rows of stringers carrying the ties and rails. The stringers are dapped over the caps of the bents and the ties are likewise dapped over the stringers, every fourth tie being bolted down to alternate stringers. The guard rails are dapped 1½ in. over the ties and lag screwed to alternate ties to prevent any shifting. Twelve-foot centers are preserved between the tracks. The piles for the outer 380 ft. of the trestle were cut off under water and the trestle framing for about 250 ft. was done under water, sometimes at a depth of from 10 to 15 ft. The work was frequently delayed on account of high water and it was severely damaged twice by the June floods. Before work was begun 27 clusters of six piles each were driven 60 ft. above the trestle on the up-stream side at intervals of 40 ft. and chain fenders were strung between them to prevent damage to the bents or trestle framing from floating driftwood which is carried down by the floods in large quantities. These clusters begin close inshore and extend out 280 ft. beyond the end of the trestle to protect the ferry barges and to form a crude slip. In spite of this protection the cradle has been put out of commission a number of times by drifting logs and debris which had to be removed before the incline could again be used.

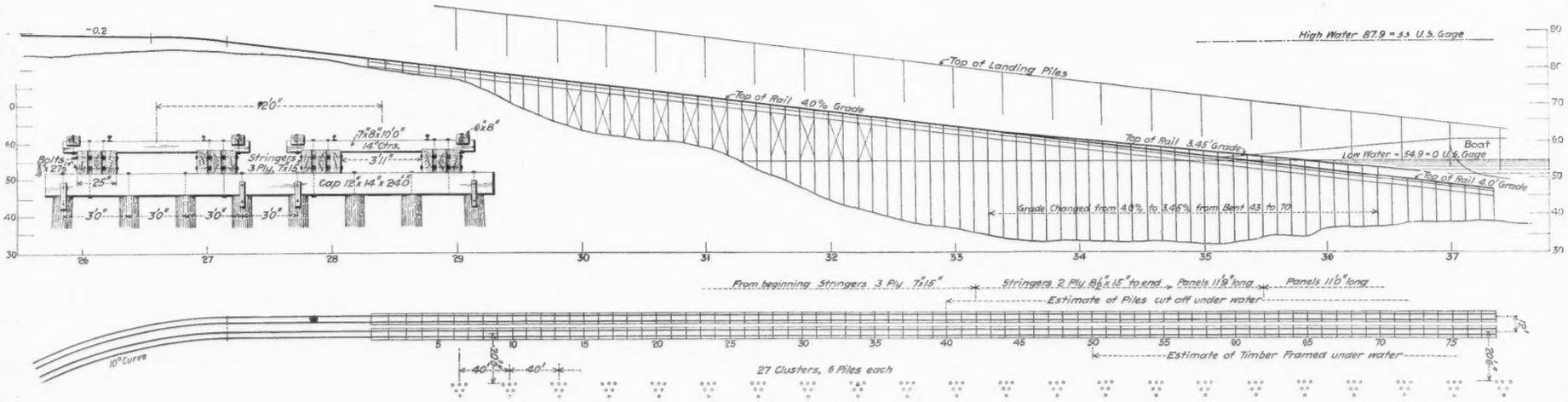
The cradle is 150 ft. long and is framed in two parts, each half carrying one track. The top and bottom stringers are 8½-in. x 15-in. timbers, packed with cribbing made up of 12-in. x 14-in. blocks to give the rail on the cradle a rising grade of 3 per cent. The bottom stringers carry cast journal boxes bolted to their under side in which the axles of the supporting wheels revolve. These wheels are mounted on standard axles with 4½-in. x 8½-in. journals. With the exception of the four pairs of wheels on the inshore end, which are 12 in. and 20 in. in diameter, all of the wheels are 33 in. in diameter. At the inshore end where the depth of the cradle will not allow the use of wheels running in journals, sliding shoes are substituted. A feather rail 12 ft. long leads from the trestle rails to the cradle rails. The plan shows the cross-framing and bracing and the location of the hoisting sheave for moving the cradle up and down on the trestle to accommodate the different stages of water.



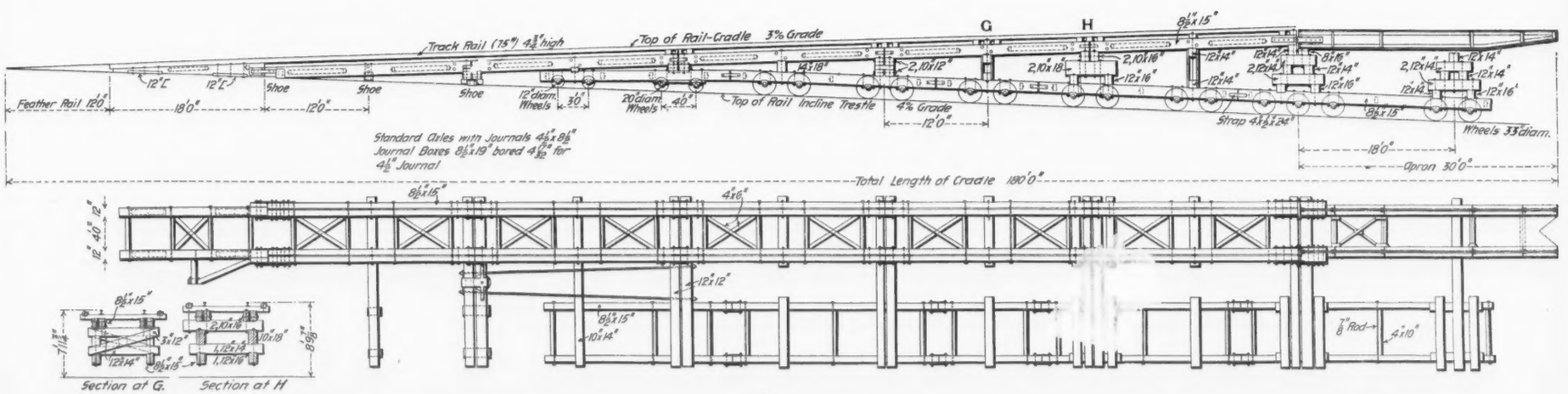
Plan of Apron and End of Barge.

The hinged apron at the end of the cradle is framed of steel with plate girder stringers 24 in. deep and light angle cross-bracing. It is 30 ft. long and is supported at the outer end on a nest of packing blocks built up on an extension of the bottom stringers of the cradle. The form of bow on the car floats is such that the apron is lifted off its outer bearing when the boat is tied up to the cradle and rests on a shelf slightly below the level of the boat deck.

The barges have four tracks 12 ft. center to center, and the necessary frogs and switches are put in on the cradle and apron, leaving the tracks on the barge clear. The frog points are located 4 ft. 6 in. from the end of the apron and a No. 6½ frog is used which places the switch point 62 ft. back on the cradle. Without using very sharp curves on the switches this brings the fouling point on the barge tracks well up toward the bow and increases the capacity about four cars over the old method of locating the switch on the barge. One steamer and one barge are at present in service between the inclines at East Ivory, Ill., and West Ivory, Mo. Most of the coal shipped from the Illinois fields into St. Louis is delivered to the Missouri Pacific tracks on the west bank of the river over this route, and a large part of the southbound shipments over the Illinois Division are ferried over the river at this point.


Top of Landing Piles
Top of Rail 4.0% Grade
Top of Rail 3.45% Grade
High Water 87.9 = 3.3 U.S. Gage
Low Water = 54.9 = 0 U.S. Gage
Boat
Top of Rail 4.0' Grade
Grade Changed from 4.0% to 3.45% from Bent 43 to 70
From beginning Stringers 3 Ply 7"x15" Stringers 2 Ply 8½"x15" to end Panels 11'9" long Panels 11'6" long
Estimate of Piles cut off under water
Estimate of Timber Framed under water
10° Curve
27 Clusters, 6 Piles each
Bolts 1"ø
Stringers 3 Ply 7"x15"
Cap 12"x14"x24'0"

Plan, Profile and Cross-Section of Trestle Incline for East Ivory Car Ferry. Missouri Pacific.


Track Rail (75#) 4¾" high
Top of Rail-Cradle 3% Grade
Top of Rail Incline Trestle
4% Grade
Standard Axles with Journals 4½"x8½"
Journal Boxes 8½"x19" bored 4¹³/₁₆" for 4½" Journal
Wheels 33" diam.
Apron 30'0"
Total Length of Cradle 180'0"
Section at G.
Section at H

Details of Movable Cradle of East Ivory Car Ferry, Missouri Pacific.

Experiments With Signal Lenses.

Dr. Charles H. Williams, of Boston, in a paper presented to the Railway Signal Association at its annual meeting at Niagara Falls, gives the record of some photometric tests of a signal light recently made by him, and he says that the best results were obtained with some lenses, designed by himself, which are convex on the front surface, with a greater curvature at the center than at the periphery, and with a concave surface on the back. This design is to be patented.

Dr. Williams started to make his experiments outdoors on the line of the Boston & Maine Railroad, but the smoke from passing trains so disturbed the conditions that he transferred his work to Marblehead, where he had a half-mile view across an arm of the harbor. He took one of Peter Gray's switch lights and had the openings glazed with thin plate glass, so as not to disturb the light when changing the lenses. He screwed the lantern to a small turntable so as to turn the axis of the lens at will 5, 10, 15 and 20 degrees from the direct line. To measure the small amount of light from a common flame at the distance of half a mile he had to improvise a photometer by using a "photographic wedge" such as is used in measuring the light of stars. This photographic wedge consists of a glass photographic negative which has been exposed to light in such a way that when developed the density of the film increases from the clear end to the dense end, in such proportion that for equal distances on the wedge, measured from the clear end, the density of the film will increase in geometrical progression (1, 2, 4, 8, 16, etc.). If such a film is held between the light to be tested and the eye, the light can be seen through the clear end, and by moving the film toward the denser end a point is found where it entirely cuts off the light. This point will vary according to the intensity of the light, and thus various lights can be compared with each other, and with any given standard, by noting the distance from the clear end to the point where the light is cut off.

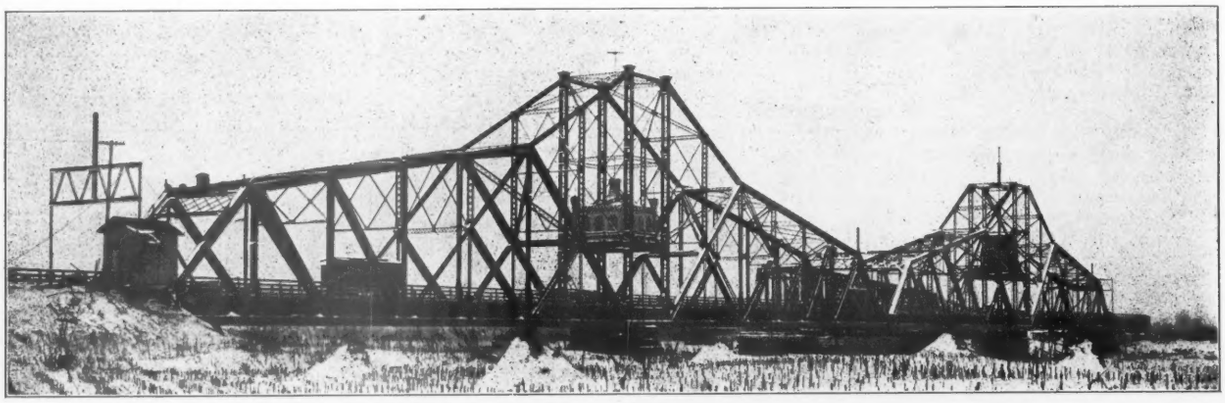
The wedge was mounted so that it could be moved horizontally in front of a tube lined with black velvet. For testing red lights a wedge-shaped cell filled with a green fluid (50 per cent. solution of nickel nitrate) was used instead of the wedge, but this was not enough better than the photographic wedge to warrant its continued use. By the gage on the wedge the comparative value of different lights was measured in centimeters from the clear end of the wedge, the figure in the record showing the point where the light disappeared. Three corrugated lenses were used and three of the new design mentioned above. With uncolored lenses, placed squarely in front of the observer, the corrugated lenses and the new design differed but little, varying from 6.0 to 6.6 centimeters; but when the lamp was turned 10 degrees to one side, the new lenses showed much better than the corrugated, the latter falling to 3.6 and 3.9, while the others gave 5.5 and 5.7. In other words, for a signal or switch on a curve or in case a light is not carefully fixed in position, the new lenses are an improvement. They are also easier to keep clean, light is thrown over a wider angle, there is less light lost from reflection from the back surface of the lens, and there are no dark rings. The new design is, however, heavier than common designs, and it stands out farther from the surface of the lantern. Other tests were made with red lights.

Dr. Williams has designed a pocket photometer. It consists substantially of his photographic wedge, with the scale marked on it at one side, and the film protected by glass. The whole is enclosed in a metal case. He estimates that this will not cost more than $2. To use this photometer the wedge is withdrawn from the case to its whole length; it is then held by one hand between the eye and the light to be tested. One finger of the other hand is held against the side of the scale to mark the level at which the light is seen. The wedge is then moved vertically up and down past this finger, until a point is found where the light is cut off. By the aid of a hand lantern the scale is then read off at the point where the finger nail rests against it.

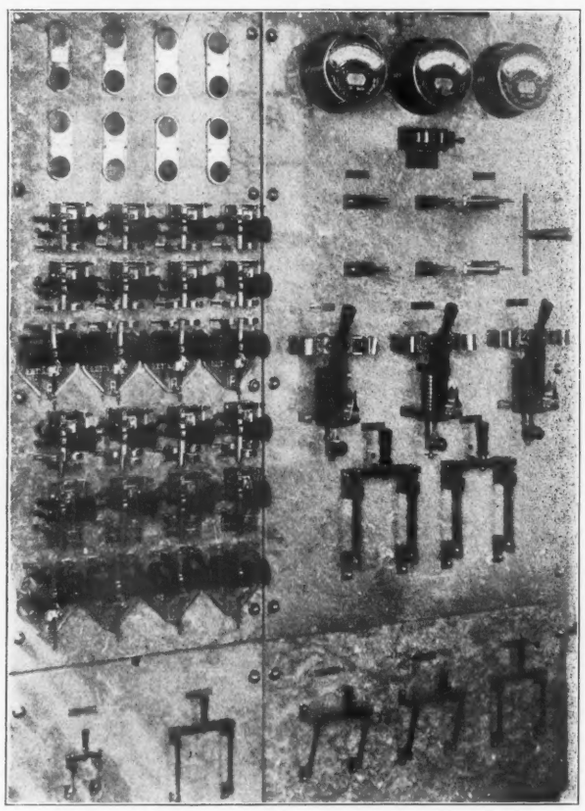
Operating and Controlling Devices of the Omaha B. & T. Co.'s Drawbridge.

The Missouri river bridge of the Omaha Bridge & Terminal Railway Company was described in these columns Feb. 24, 1905. It consists of two 520-ft. draw spans placed tandem, the longest drawbridges in the world. One was built in 1893, and the other was completed in January last.

In arranging for the operating and controlling devices and for the signals guarding the approaches, the idea constantly in mind was to render it impossible for the operator intentionally or by any blunder to perform any of the motions or operations out of its proper order; to permit the operation of the bridge when the signals were clear for trains; or to clear the signals when the bridge was not in condition to permit trains to pass over safely. The motive power is electricity, which is taken from two independent circuits, one on each side of the river. The feeders as well as all



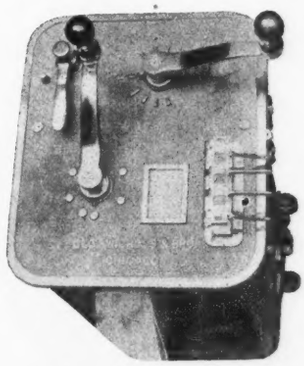
New Bridge of the Omaha B. & T. Co. Across the Missouri River (From the Iowa Side).



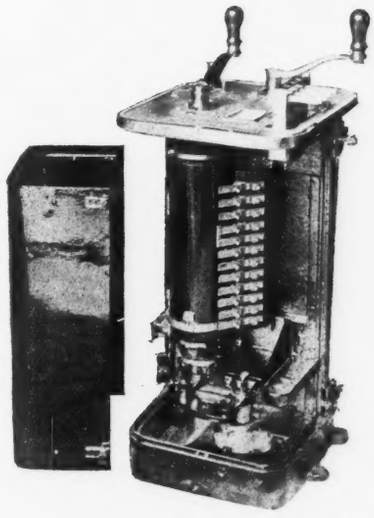
Switchboard—O., B. & T. Co. Drawbridge.

of the signal and indicator wires are brought to the operator's house through overhead spans ending in a swivel pole, at the bottom of which is a set of insulated collector rings for making connections at all points in the rotation of the bridge. The swinging of the draw span is performed by two 40 h.p. street railway type motors mounted directly on the machinery inside of the drum. The end lifts, which are of the wedge type, are moved by two 20 h.p. compound motors—one at each end of the bridge.

The rail locks at each end of the bridge are worked by compressed air, one cylinder being connected to all of the rail locks at one end. The semaphores are operated by primary batteries, the home signals being placed about 500 ft. from each end of the bridge, and the distant signals about 1,000 ft. in advance of the home signals. The railroad line is single track but the bridge is double track, requiring a double-track signal system. All signals are normally at danger, requiring trains to approach the bridge under control.



Top of Controller Box—
O., B. & T. Co.'s Drawbridge.



Controller O., B. & T. Co.'s Drawbridge.

The entire control of the signal system and the bridge is effected through a single controlling stand designed especially for this bridge. The semaphores being normally at danger, no train is permitted to enter the bridge without the signal of its track first being cleared by the operator. The levers controlling the semaphores are mechanically interlocked to make it impossible to allow trains to approach the bridge from opposite directions on the same track.

Taking up the movements in the order of their occurrence, it will be seen in the engraving of the top of the controlling stand, that the left-hand handle, which controls all movements preliminary to the actual swinging of the bridge, is standing at point 1. In this position the signals are under the control of the operator. Moving the handle from point 1 to point 2 breaks the signal circuits, permitting all signals to go to danger; and until this is accomplished it is impossible to move to point 3, the controller drum being locked in position. In position 3 a four-way air valve

Operators' Direction Card—O., B. & T. Co. Drawbridge.

at the bottom of the controller box is opened and the air cylinders for moving the rail locks are set in operation. There are eight of these locks, which are connected up in series by an electric circuit. This circuit is completed only when all eight locks are released; and until the circuit is formed the controller is locked, preventing movement of the handle to the next position. Position 4 starts the 20 h.p. wedge-moving motors. When each motor has made the proper number of revolutions to have withdrawn the wedges, the current is automatically cut off by means of a special stop device and the connections left so that the motor cannot be run any further in that direction but can be reversed readily at the proper time. When the wedges have been withdrawn, the handle can be moved to 5, which unlocks the second controller, moved by the right-hand handle. This latter controller, which governs the bridge-swinging motors, is a General Electric standard series-parallel controller for 40 h.p. motors. The first drum remains locked at point 5 until the bridge is back in normal position. When the rails are exactly in line, electric contacts are formed at the ends of the bridge which release this drum and permit the operator to perform in reverse order the several operations already described. The handle, however, continues to move in the same direction through a complete revolution back to point 1. In engraving of the controller will be noticed a rectangular space near the center of the top of the box. This is for the insertion of the card giving exact instructions to the operator.

In addition to having the controller drum locked until the next movement can be performed safely, each movement is visually indicated by means of red and white lights on the switchboard. These indicating lamps may be seen in the engraving at the top of the board at the left-hand side. There is also placed on the board for the instruction of the operator a card, 3 in. x 6½ in., which is reproduced. Each lamp is marked in accordance with its indication, the markings under the lamps corresponding to those shown on the card.

The operator's house, which occupies an elevated position at the center of the span, is fire-proof, with steel framework, concrete floors and walls of Portland cement plaster on expanded metal laths. It contains the switchboard, controller and an electric compressor. The compressor is the regular street car type with a capacity of 50 cu. ft. of free air per minute. It is entirely automatic in its operation, uniform pressure being maintained at all times in the reservoir.

The entire operating, interlocking and signal system was designed and installed by Geo. P. Nichols & Bro., Chicago, from general specifications prepared by Waddell & Hedrick, designers of the bridge.

Effects of Work and Heat on the Quality of Rivets.

At the July meeting of the Academy of Science (France) Mr. C. Fremont presented a note in which he discussed the quality of rivets used in bridges, structural work and boilers.

In order to properly investigate the subject he took seven specimens of Swedish iron, from those in common use, having a tensile strength of 47,000 lbs. per sq. in. and six pieces of steel whose strengths varied from 50,000 lbs. to 78,000 lbs. per sq. in. Three specimens were taken from each of the seven samples intended for tensile and bending stresses, both static and dynamic. One of these three pieces was tested in its original condition, that is to say, just as it was cut from the bar and without receiving any treatment whatsoever either thermal or mechanical; the second was heated in the forge to the temperature at which rivets are usually driven, that is to say from 1,650 deg. to 2,000 deg. Fahr., but received no mechanical treatment; finally the third specimen was made into a rivet, then driven hot by a machine under a pressure of about 55,000 lbs. and then completely removed so that it could be used like the two preceding specimens for the various tests of tension, bending, etc.

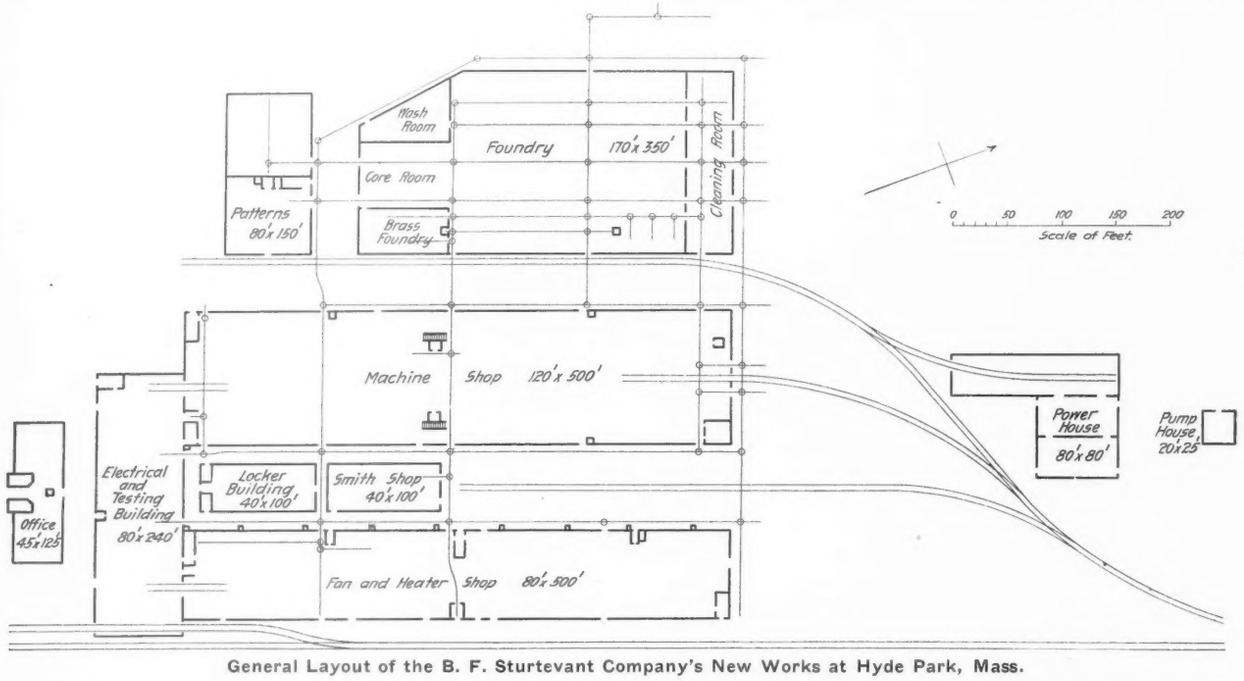
The following table gives the results of these tests, and it may be stated that the metal after having been subjected to mechanical contraction in cooling under tension is visibly improved.

The result of the shock tests upon these bars shows that their brittleness was not increased, so that the increase of tensile strength did not have the effect of temper as might have been supposed.

		Limit of elasticity.	Ultimate strength.	Reduction of area per cent.	Resistance to shock.
Swedish iron	Natural.	23,343	47,678	0.55	24,123
	Heated.	23,343	47,678	0.49	26,961
	Riveted.	36,894	61,585	0.54	25,542
Mild steel (marine q'lity)	Natural.	27,671	50,658	0.65	31,218
	Heated.	23,910	49,665	0.63	36,894
	Riveted.	36,894	61,585	0.66	34,056
Mild steel (structural)	Natural.	32,979	64,565	0.62	85,140
	Heated.	34,056	60,591	0.61	28,380
	Riveted.	49,026	78,471	0.59	14,190
Nickel steel (3%)	Natural.	39,023	62,578	0.63	31,218
	Heated.	31,928	59,798	0.65	26,961
	Riveted.	56,760	81,451	0.62	38,313
Semi-hard steel (marine)	Natural.	34,766	69,531	0.57	85,140
	Heated.	31,928	68,538	0.59	70,950
	Riveted.	56,760	92,235	0.59	11,352
Nickel steel (5%)	Natural.	42,570	70,524	0.66	32,637
	Heated.	44,911	70,524	0.64	31,218
	Riveted.	75,491	103,303	0.64	41,151
Semi-hard steel (German)	Natural.	42,570	77,477	0.64	14,190
	Heated.	41,151	79,464	0.65	14,190
	Riveted.	52,148	90,390	0.61	31,218

The B. F. Sturtevant Company's New Works.

The general layout of the new works of the B. F. Sturtevant Company at Hyde Park, which is about nine miles from Boston, Mass., is shown in the accompanying illustrations. The plant is essentially a commercial one, and therefore a detailed description of it would not be of special interest to railroad men; although the following description of the general layout may be suggestive at least, inasmuch as careful study was given to it, which resulted in a most systematic method of progressively handling the various machine parts from the foundry to the shipping room with a minimum amount of labor. The plant occupies a tract of about 20 acres and the buildings consist of a foundry, 170 ft. x 350 ft.; a pattern shop, 80 ft. x 150 ft.; a machine shop, 120 ft. x 500 ft.; a fan and heater shop, 80 ft. x 500 ft.; a testing shop, 80 ft. x 240 ft.; a smith shop, 40 ft. x 100 ft.; a locker building, 40 ft. x 140 ft.; an office building, 45 ft. x 125 ft., and a power house, 80 ft. x 80 ft.



General Layout of the B. F. Sturtevant Company's New Works at Hyde Park, Mass.

jery floors which are designed for 200 lbs. load per sq. ft. are of 2½-in. plank; other upper floors are 2-in. plank for 200 lbs. load per sq. ft. Maple top flooring is used in all cases and all roofs are of 3-in. plank with tar and gravel top.

The entire plant is electricly driven and lighted at 220 volts from a central power house containing one 100-k.w. and one 250-k.w. Sturtevant generating set; the power plant engines run condensing and the exhaust steam derived from the engines under test upon the plate in the testing building is utilized for heating; supplementary live steam being admitted to the heating system at reduced pressure as may be required. The waste exhaust is discharged through a Sturtevant exhaust head. The boilers are equipped with Sturtevant fuel economizers for heating the feed water, and with the Jones under-feed system of mechanical stoking.

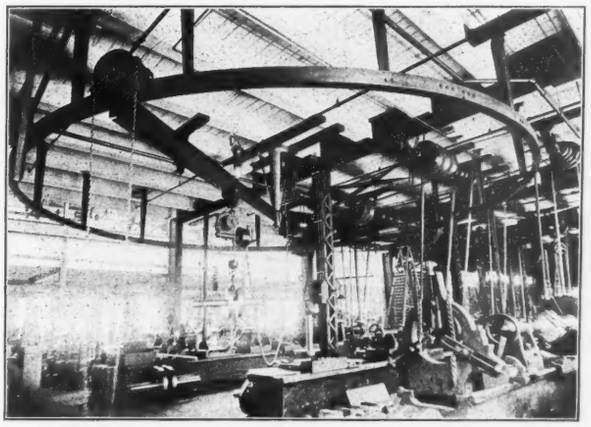
Steam, electricity and compressed air are transmitted to the individual buildings through a concrete tunnel and a supplementary system of covered trenches. The machine shop is of the gallery

General View of the B. F. Sturtevant Company's New Works at Hyde Park, Mass., Showing Power House in the Foreground.

The floor area totals up to about nine acres, which is slightly more than double that of the company's old plant which was located at Jamaica Plain, and which was destroyed by fire a few years ago. The buildings are somewhat composite in their construction, consisting of steel interior columns and main steel girders, with heavy brick walls, wood timbered floors and plank roofs. The foundry is of one story and the roof is supported by steel trusses; but in the other buildings open timbering with wooden columns in the upper floors is used. The main floors in the machine, fan and erecting shops are of tar concrete, upon which 3-in. hemlock is bedded in liquid pitch and toe-nailed together. The upper floors are carried upon hard-pine beams on 4 ft. centers spanning the spaces between the steel girders which follow a unit system of 20 ft. on centers throughout the buildings. The machine shop gallery type with wings 40 ft. wide, having a central craneway of the same width designed for a crane of 20 tons capacity; making a total width of 120 ft. The lighting, which is remarkably effective, is secured principally by a series of saw-tooth skylights running crosswise of the roof with the glass facing due north. The upper floor of the building is devoted to the electrical department and is provided with individual small traveling cranes. Both standard and narrow gage tracks enter the machine shop at the end farthest from the erecting shop. Generally speaking, large castings and forgings pass in at this end and are transported by the crane, while smaller parts are brought in through numerous side entrances and are handled by hoists or by manual labor. Industrial tracks also cross the building at the center and at both ends. The heavy machine tools are driven by direct connected Sturtevant motors

and are arranged in the open craneway and consist in part of two Detrick & Harvey open side planers, one a 60-in. and the other a 72-in.; a 6-ft. and a 7-ft. Baush radial drill; a Beaman & Smith horizontal boring mill with 60-in. swing, and a 48-in. Johnson lathe. Beneath one of the side galleries is a line of planers included in which is a Cincinnati 60 in. x 48 in.; and a group of radial drills and several horizontal boring mills, which are all served by traveling cranes on a continuous runway. Beyond these are the large vertical and planer type milling machines. The smaller tools are driven in groups, by means of 20-h.p. motors suspended overhead. The grinding and polishing room is on the main floor and is equipped with a Sturtevant exhaust fan, hoods and piping.

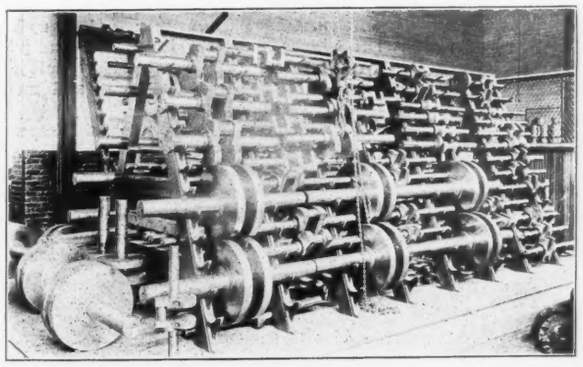
In the fan shop are installed large shears and brakes for cut-



Circular Overhead Crane with Supported Center, Fitted with a 2-Ton Rand Air Hoist—B. F. Sturtevant Company's New Works.

ting and folding plates up to 120 in. in length and rolls for handling ½-in. plates 120 in. wide. Pneumatic punches, riveters and chippers are also extensively used. All plate iron is stored on edge in diagonal alcoves in the storage shed, which has capacity for nearly a thousand tons. Special attention was given to the testing plant, which has proved most valuable in conducting the rigid tests demanded by the United States Navy Department upon the engines, generatinng sets and engine and motor driven fans which the company has furnished to the government in large numbers.

All of the buildings are heated and ventilated by the Sturtevant system. In the machine shop the hot air pipes are hidden beneath the second floor wall benches and deliver most of the air downward to the first floor. The fan and erecting shops are supplied through an underground duct which delivers the hot air to specially constructed external vertical flues upon one side of the



Special Rack for Storing Crank Shafts—B. F. Sturtevant Company's New Works.

building which in the case of the fan shop are located 40 ft. on centers and discharge the air across the building above head level. The B. F. Sturtevant Company is especially proud of the fact that a large amount of its new equipment was made and installed by its own works. Aside from the motors, engines, heating and ventilating systems, forges, etc., which the company regularly makes, it also designed and constructed its entire industrial equipment, which consists of a complete industrial railroad system, including the platform, coal, charging and dump cars, ladle trucks, truck ladles and turntables. The company also made a large part of its general factory equipment, such as cast-iron bench legs, electric hoists, wash-sinks, shelf-brackets for pattern storage, manhole and catch basin covers and frames, trench cover plates and pipe hangers.

Cost of Stopping Trains, Compared With Cost of Interlocking Signals to Avoid Stops.*

There exists in the minds of most railroad officers the idea that, if the factor of safety is left out, an interlocking plant is a luxury at any place where traffic is not so great that one is required to facilitate the movements so that all may be handled without increasing the track facilities, or where the time to be made by fast trains makes necessary the saving of every minute possible.

It has been my belief, for a long time, that this idea was erroneous and when a Division Master Mechanic made the statement that the temporary removal of a certain interlocking plant had cost his company $1,200 a month for additional coal consumed on account of the additional stop for all trains, the fact was strongly impressed upon me. Inquiries made of various officials as to the cost of stopping an average train brought forth a wide divergence of opinion ranging all the way from five cents to five dollars. An official of a western road says:

"For trains such as Nos. 55 and 56, regularly eight cars between .....and....., and seven between.....and....., and total weight including engine and tender half loaded about 530 tons, the various items of stopping and starting, from and to a speed of 50 miles an hour are estimated as follows:

Coal to stop train (air pump)	30 lbs.	
Coal to accelerate train	275 "	
Total coal	305 lbs. at $2.15 per ton	$0.33
Brake shoe wear and tire wear		.03
Wear of brake and draft riggings and miscellaneous		.06
Total		$0.42

"The cost of brake shoes per stop is estimated from some experiments now being conducted by the laboratory. The cost of tire wear, brake rigging wear, are estimated.

"Tests recently made on trains Nos. 55 and 56, the point at which steam was shut off and the speed were noted and also the point at which the speed at shut-off was attained after starting up. The time in which the train would have covered this distance if no stop had been made, substracted from the time it actually took, gives the time lost on account of stop, exclusive of time standing at the station. The time lost at various stations, exclusive of time standing at station, was as follows:

	Direction.	Speed at time steam shut off.	Seconds lost on account of stop.
Station A	West.	52 m. p. h.	166
" A	East.	54 "	197
" B	West.	59 "	129
" B	East.	48 "	335
" C	West.	39 "	90
" C	East.	60 "	180
" D	West.	52 "	155
" D	East.	45 "	121
" E	West.	52 "	119
" E	East.	42 "	95

"Thus the time lost in making a stop (exclusive of time standing) on a straight and level track averages about 145 seconds.

"The records of some tests of train No. 56 made in 1901, before the.....interlocking plant was installed, have been gone over and compared with the tests on No. 56 recently made. The tests show that the interlocking plant has saved 85 seconds on the time of this train.

"The cost of stopping and starting a 2,000 ton freight train (80 cars) from and to a speed of 35 miles an hour would not be far from $1.00, itemized as follows:

Coal to stop train (air pump)	50 lbs.	
Coal to accelerate train	500 "	
Total coal	550 lbs. at $2.15 per ton	$0.56
Brake shoe wear		.15
Other items (as classified above)		.29
Total		$1.00

"In both the foregoing calculations, the figures of coal used by the air pumps are based on tests; that required to accelerate the train calculated; and the item of brake shoe wear is estimated from tests now going on; all other items are purely estimates."

Another road gives me the following estimate:

Six-Car Passenger Train; 45 M. P. H.

Coal for starting train and for air pump	$0.28
Cost of wear and tear on brake rigging and shoes	.07
Total	$0.3[illegible]

1,500-Ton Freight Train; 15 M. P. H.

Cost for starting train and air pump	$0.40
Cost of brake rigging and shoe wear	.1
Total	$0

"These amounts do not take into consideration tire wear, possible wheel sliding, wear and tear of draw-bars and other wear and tear on brakes, or liability of injury to freight in cars and possibly breaking in two when stopping or starting. These figures would possibly increase the total five to six cents in the case of a

*A paper by J. A. Peabody, Signal Engineer of the Chicago and North-Western, presented before the Railway Signal Association, at Niagara Falls Oct. 10-12, condensed.

passenger train and 12 to 15 cents in the case of a freight train."

A recent experiment on still another road showed the following results:

"A 24-car freight train of 900 tons was stopped from a speed of 45 miles an hour, and accelerated to a speed of 45 miles an hour after having run over the same distance at the same place. There was a loss of four minutes of time and the additional use of 440 lbs. of coal. The total distance covered in making this test was five miles, and care was taken to have the locomotive fire as near as possible the same at the beginning and end of each trip."

As all these figures were made on separate bases, they cannot be directly compared. I have considered that the figures of the second man's estimate were so conservative that they could not be disputed, and will use the average obtained from them (45 cents in round numbers) in the following illustrations, as the cost of stopping any train; in all of these illustrations it is assumed, unless otherwise noted, that additional men have to be employed to operate the interlocking plant.

The figures used for the cost of installing plants are high, and allowance is made for electric locking, annunciators, etc., as usually installed in modern plants. The charges for maintenance and operation are sufficient for first-class work. The average interlocking plant with proper maintenance will last 20 years, but to be on the safe side, I have only allowed for a life of 15 years. Each actual case should, of course, be taken up as a separate proposition; far better results can usually be shown than are given in these examples, as freight trains are generally more numerous than passenger, and the average saving per train would be increased in proportion.

Example 1.—Entrance to a yard from a double track; crossover, four derails, four high signals, six dwarfs.

Cost of interlocking plant complete	$8,000
Interest on cost at 4 per cent.	$320
Depreciation per year, 7 per cent.	560
Cost of maintenance per year	840
Cost of operation per year	1,440
Total cost per year	$2,800

Saving to be Effected.

Trains pr day.	Cost per year for stopping trains.	Total cost interlocking per year, as above.	Net saving per year.	Time required to pay for installation ($8,000) from saving.	Saving —capitalized at 4 per cent.
17	$2,800	$2,800	.....	....	.....
20	3,285	2,800	$485	16.5 yrs.	$12,125
25	4,105	2,800	1,305	6.13 "	32,625
30	4,930	2,800	2,130	3.8 "	53,250
50	8,210	2,800	5,410	1.48 "	135,250
70	11,495	2,800	8,695	11 mos.	217,378
80	13,140	2,800	10,340	9.3 "	258,500
100	16,425	2,800	16,625	7.0 "	340,625

Example 2.—A single track crossing a single track; four derails, eight high signals.

Cost of interlocking plant complete	$7,000
Interest on cost at 4 per cent.	$280
Depreciation per year, 7 per cent.	490
Cost of maintenance	420
Cost of operation per year	1,440
Total cost per year	$2,630

Saving to be Effected.

Trains pr day.	Cost per year for stopping trains.	Net saving.*	Time required to pay for installation ($10,500) from saving.	Saving —capitalized at 4 per cent.
16	$2,630	.....	....	.....
20	3,285	$655	10.7 yrs.	$16,375
25	4,105	1,475	4.75 "	36,875
30	4,930	2,300	3.0 "	57,500
40	6,570	3,940	1.8 "	98,500
50	8,210	5,580	1.25 "	139,500
60	9,855	7,225	1.0 "	180,625

*Cost of stopping, minus $2,630.

Example 3.—A single track crossing a double track; six derails, eight high signals, two dwarfs.

Cost of interlocking plant complete	$8,000
Interest on cost at 4 per cent.	$320
Depreciation per year, 7 per cent.	560
Cost of maintenance per year	840
Cost of operation per year	1,440
Total cost per year	$2,800

The saving would be the same as in Example 1.

Example 4.—A single track crossing a double track, including four station switches; total switches, derails and signals, 26.

Cost of interlocking plant complete	$10,500
Interest on cost at 4 per cent.	$420
Depreciation per year, 7 per cent.	735
Cost of maintenance per year	480
Cost of operation	1,440
Total cost per year	$3,075

Saving to be Effected.

Trains pr day.	Cost per year for stopping trains.	Net saving.*	Time required to pay for installation ($7,000) from saving.	Saving —capitalized at 4 per cent.
19	$3,075	.....	....	.....
25	4,105	$1,030	11.9 yrs.	$25,750
30	4,930	1,855	5.6 "	46,375
40	6,570	3,495	3.0 "	97,375
50	8,210	5,135	2.0 "	128,375

*Cost of stopping, minus $3,075.

Example 6.—Single track drawbridge assuming that men are already employed who can operate the signals; two derails, four signals.

Cost of interlocking plant complete	$6,000
Interest on cost at 4 per cent.	$240
Depreciation per year, 7 per cent.	420
Cost of maintenance per year	420
Cost of operation per year (supplies only)	120
Total cost per year	$1,200

Saving to be Effected.

Trains pr day.	Cost per year for stopping trains.	Net saving.*	Time required to pay for installation ($6,000) from saving.	Saving —capitalized at 4 per cent.
7	$1,200	.....	....	.....
10	1,640	$440	14.0 yrs.	$11,000
15	2,465	1,265	5.0 "	31,625
20	3,285	2,085	3.0 "	52,125
25	4,105	2,905	2.0 "	72,625
30	4,930	3,730	1.6 "	93,250

*Cost of stopping, minus $1,200.

Mr. Peabody also gives estimates for a double track crossing a double track; for a single track drawbridge assuming that extra men will be required to operate plant; for a double track drawbridge assuming that men are already employed who can operate the plant; and for a double track drawbridge, assuming that extra men will be required to operate the plant.

The Organization of Shop Forces.*

In getting together a force of men sufficient to man a shop capable of turning out 20 to 50 locomotives a month, the first consideration is to pick a man for the head who can be implicitly relied on to carry out the plans you formulate for him, and to have such ideas of his own that he will immediately see where delay or friction occurs and apply a remedy. He must have a firm disposition, be prepared to meet emergencies, have the good will of the foremen and men under him, and be tactful so as to be able to straighten out the many little difficulties that are continually arising. It is far better if he has no relatives or friends working for him as it will save lots of trouble from fancied discrimination. He should not allow work to be done carelessly or improperly; it takes a long time to build up a reputation for thoroughness which can be shattered in a few weeks if work is slighted.

When an engine comes into the shop for repairs, it should be the duty of one or more men to inspect it, and immediately order all of the new material required, and see that it is placed at the machines or benches ready to be worked on when its time comes—don't wait two or three days after the engine arrives, and then find you want something that isn't in stock but ought to be.

In taking down engines each part should be plainly marked so that when wanted again, there will be no difficulty in finding it; the storage of parts that need no repairs is a matter worthy of attention, much material is lost through storing it where it cannot readily be found when wanted.

To get engines or work out of a shop, there should be a classification of repairs, and each piece of work done, or each engine passing through the shops, should have a schedule of time, so that all concerned know when it will be necessary for the various parts to be ready. Don't do things haphazard. Set a time limit and work to it, making such improvement in tools, ways and means of doing work, that all lost motion is taken up.

The head of the shop should have good foremen, all knowing their business thoroughly and being able to handle men with consideration, firmness and fair dealing. These combinations are frequently hard to get, but with a large force of men to pick from, the right kind of men can be found, who, by a little training, will meet the requirements.

A good plan to adopt with your foremen is to hold weekly meetings for, say an hour, and review the work that has been done and that which is ahead of them. Let them tell you how conditions can be improved, what is delaying their work, etc. This getting together is very helpful to the Superintendent of Shops, as he quickly gets in touch with details, and at such times he can say what results he is after and offer encouragement to get them.

The Shop Superintendent who is wise, will lend an ear to suggestions made by his foreman or men when they can show a way by which better results can be obtained; once make light of or ridicule a suggestion from any one, however humble in position, and another will not be offered. The mechanic who tells you that a certain casting has more metal on it than is necessary, is helping you to get results and the least you can do is to listen, and try to remedy the trouble by asking to have the pattern changed.

The organization of shop forces does not end with getting together good foremen and men; it is also necessary to have such a systematic arrangement of accounts and reports that you will not only see that the men are getting the work out promptly, but

*From a paper read at the September meeting of the Western Railway Club, by H. T. Bentley, Assistant Superintendent of Motive Power of the Chicago & North-Western.

can tell at a glance how much is being done and what it is costing; without this knowledge you are not able to perfect the organization to its fullest extent; it also enables you to say when asking for new tools, what can be saved in time and money by their introduction, and to know whether it will be cheaper and better to purchase such things as taps and reamers, or make them in the shops.

The Superintendent of Motive Power who visits his shop frequently and knows all his foremen, can get better results and have the men feel more kindly disposed towards him than the one who does all his visiting by long distance telephone; a word of encouragement and a suggestion will often bring out latent ideas that otherwise might have lain dormant. It is natural for most men to like their superiors to come in personal contact with them and see what they are doing and whether advantageously or not; hence, the advisability of the Superintendent of Motive Power or his assistant, making frequent visits to the most important shops and keeping in close touch with the Shop Superintendents and foremen.

A Volunteer Fire Company formed of the men who have been in the service some time and are likely to stay there, should be formed, and a man put at the head who can handle them properly; they should practice at least once in two weeks, familiarizing themselves with fire hydrants, hose, etc. A little encouragement from the officials in charge will keep up enthusiasm, and at a critical time, your volunteer company may be in a position to save you thousands of dollars and keep the shops from burning down and throwing themselves and co-workers out of employment. A watchman system which will necessitate the patrolling of the shops at stated intervals, will often be the means of catching an incipient fire. The checking up of watchmen to know that they are making their rounds at stated intervals is necessary, through the medium of some check clock system.

The organization of forces includes prompt movement of work and tools to the men. What does it profit a Superintendent of Shops if he has a first-class machine and an up-to-date man handling it, if the man has to tie it up several times a day while he goes to get a tool dressed or sharpened, or because the supply of material is not on hand when wanted. A sufficient number of tools properly sharpened and dressed should be available at all times, within easy reach of the mechanic, or better still, have a boy who can keep the men supplied.

A shop telephone system will aid in getting out work and will enable foremen to quickly obtain information from each other, or from the Shop Superintendent and vice versa, and save endless running about which is a waste of time and energy.

The placing of machine tools so that the minimum amount of handling material takes place, will increase the output and save disorder and unnecessary work; where possible a piece of work should travel from foundry, storehouse or blacksmith shop to the various machines and never make a retrograde movement, and when completed, should go direct to its resting place, which should not be around the man or machine finishing it. Always have plenty of unfinished work before your men and remove that which is completed soon as possible.

Labor saving devices can be carried to extremes. Put an air or electric hoist where it will save delay in handling work, but don't put anything up that will cause a man to wait until some one else has finished with it, when, without it, he would have handled the work himself in a quarter of the time, if no power hoist had been available. Pneumatic hammers and drills are indispensable in doing work quickly and should be used wherever possible; but to have 50-ton hoists handling 50-lb. loads, is a waste. Keep your pneumatic tools in first class shape and stop all air leaks.

The Mechanical Engineer, while not directly coming under the head of Organization of Shop Forces, is a potent factor in getting results. A bad feeling exists among foremen when castings or forgings come to their machines improperly designed or with more metal on than is necessary. The frequent breakage of parts that could be readily corrected, is something that the Mechanical Engineer's office is often responsible for, and a man in this position who quickly corrects complaints that are made to him, enables the shop organization to be perfected in a way that few people realize.

The foreman boilermaker who finds that an engine is coming into the shops for a new firebox, does not wait until the engine is actually in the shop before he takes action looking towards the building of a new firebox, so that as soon as the old one is removed, the new one will be ready for application; the same with engines requiring new side or flue sheets.

The blacksmith shop generally is not a place that looks neat and tidy; but orderliness pays there just as much as anywhere else. The turning out of duplicate work by machine, instead of by hand, makes a big reduction in cost, and the foreman blacksmith who can organize his work and men so that he is always in the van instead of the rear, is a valuable addition to the shop organization.

The tank shop, tin shop, paint shop and brass and iron foundries all play their parts in getting results; it is of no avail if the machine and erecting shop have the engines finished on time if they have to lie around two or three days waiting for the tender.

The power plant is an important factor in the smooth running of a shop. Engines too small to carry a load, and boilers that do not furnish enough steam, are a trial and tribulation. Relay engines and boilers cost money but often save shutting up shop when it can least be spared.

Apprentices should be given opportunities to learn their business thoroughly, as we depend upon them to make our future mechanics; if they are looked upon and treated as necessary evils, we may expect indifference and indolence from them; but if treated properly, and shown how to do their work efficiently and quickly, they will, in most cases, turn out desirable men to keep in the shops. Special apprentices, who have graduated from a technical college, are invaluable if made of the right kind of stuff. In a large establishment conditions are often arising where some special information has to be obtained, which necessitates mechanical training, and a certain amount of technical knowledge to properly work up the data. In this field, special apprentices can be used to advantage, and later, when they have completed their term of apprenticeship, if competent, they can be used in higher positions to advantage.

This is the age of Specialists and in hiring men you will find some who are first-rate mechanics in one line and not much good in another. The good all-around mechanic, like the old family physician, is disappearing from our midst and instead, we get the Air-Brake Man, Machine Hand, the Valve Setter, the man who is handy at lining up guides, etc. Find out what your man's forte is and use him at it, wherever possible; in a large shop, this can be done to advantage with a corresponding increase in your output.

Always be on the outlook for promising timber in the shape of young, energetic and progressive men and encourage them, so that when in want of a foreman or master mechanic, you will know where to find one. Many a good man has been lost to the profession through lack of encouragement. Nothing stimulates a man so much as to know that his work is appreciated. Don't have too many rules, bulletins and notices, they take up the men's time reading and discussing them. Only make rules that you know can and should be carried out, and then see that they are lived up to.

The Motive Power Department organization can be nearly put out of business if it is not backed up by the Storekeeping and Accounting Departments. The prompt furnishing of material in sufficient quantities to keep machines going long enough to perform the work economically is a matter that must have attention, otherwise the cost will immediately go up. The setting up of some machines often takes longer than to do the work, if furnished in small amounts, and a direct loss to the company takes place. The furnishing of cost sheets within reasonable time after the work is done is very helpful in detecting increased or decreased cost and applying the remedy if needed, before the matter gets old. In some shops messengers are used to deliver material and they are great time savers when used in connection with a shop telephone system. The ordering of material is done by 'phone to storehouse and deliveries are made from there by boys or men, thus obviating the necessity of high priced mechanics going back and forth doing work that is just as well performed by cheaper labor.

Nothing looks so bad in a shop as material, whether usable or scrap, being allowed to lie around indiscriminately—a man is frequently what his surroundings are; try both methods and you will quickly find that a dirty shop is the most expensive to handle. Have distinctive marks on scrap and usable material, and see that it goes where it belongs when once picked up—it is cheaper than to set it down and pick it up later on.

The following requisites are necessary to get the best results:

A good man at the head of the shop.
Good foremen under him.
The education of foremen and men.
Proper control of men by foremen.
Punctuality.
Orderliness.
System.
Harmony.
Prompt movement of material to and from the various departments.
A good system of handling tools.
The use of templets and jigs wherever possible.
Absolutely fair treatment of foremen and men.

The Damascus-Mecca-Haifa Railroad.

The Hedshas Railroad, the line from Damascus to Mecca, with branches to the Mediterranean and the Red Sea, which the Turks are building primarily for the carriage of pilgrims to and from the Mohammedan holy cities, is making better progress than any purely industrial enterprise in that country, the funds coming very largely from contributions by the faithful and also much of the material, as timber and stone. The work was begun in March, 1902. On Sept. 1, 1904, 285 miles of the main line, from Damascus southward, and 48 miles of the branch from the Mediterranean at Haifa eastward across Palestine to the River Jordan, were open for traffic, and at the same date this year an extension of 56 miles of the main line and of 52 miles of the Haifa branch were completed. The extension of the branch required the heaviest work on the line, rising as it does from 850 ft. below sea-level at the Jordan to 1,210 ft.

above the East Jordan plateau. The present eastern terminus at Deraa was formerly the royal residence of Og, king of Bashan. The Chief Engineer of the railroad is a German, named Meisner, and his corps of engineers includes 17 Turks, 12 Germans, 5 Frenchmen, 5 Italians, 2 Austrians, 1 Belgian and 1 Greek. It is expected that some of the Turks will have become capable of taking entire charge of the work when the vicinity of the holy cities is reached. Infidels would hardly be safe there.

Railroad Shop Tools.

MILLING MACHINES.

(Continued.)

The accompanying illustration, Fig. 1, shows a No. 5 horizontal milling machine fitted with two vertical spindles, made by the Niles-Bement-Pond Company, New York. This machine is specially adapted to do a great variety of slab milling work, and carries besides the horizontal spindle, two vertical spindles, which enable

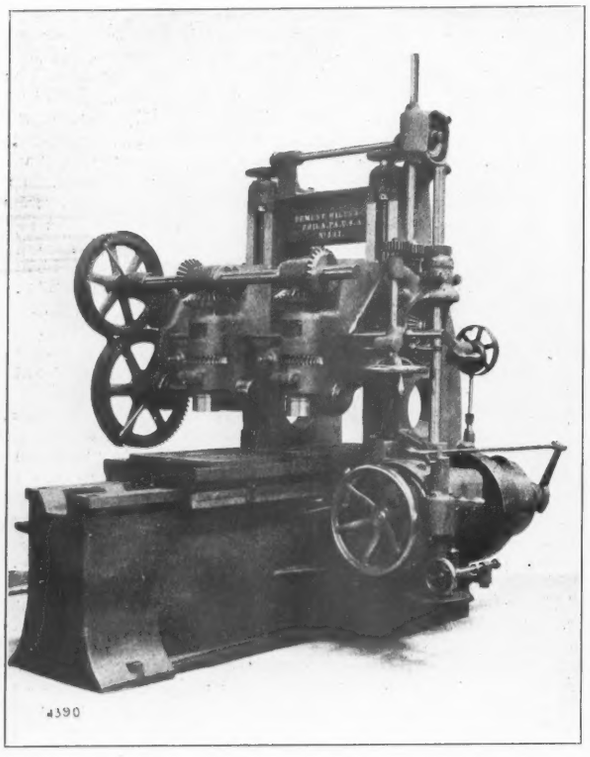


Fig. 1—The Niles-Bement-Pond No. 5 Horizontal Milling Machine.

a variety of irregular work to be finished without the use of expensive form milling cutters. The machine will take 24 in. between the housings. The main bearings for the horizontal spindle are incorporated with the bearings of the vertical spindles. The vertical spindles have an adjustment of 3 in. and the maximum distance from the lower end of spindles to table is 20½ in. The distance from the center of the vertical spindles to the center of the horizontal spindle is 7 in. Fig. 2 shows a No. 6 horizontal milling machine made by the same company. The machine as shown in the illustration is driven by a 25-h.p. Westinghouse motor, with speed variations from 560 to 1,120 r.p.m. These speeds in conjunction with the changes by gearing give a speed range to the spindle of from 8 to 36 r.p.m. The cross-rail is raised and lowered by a 3½-h.p. motor mounted on the top of the housings. This type of machine is particularly applicable for channeling and surfacing the main rods and side rods of locomotives. One of its principal advantages over the planer for this work is that it leaves the rod in one cut with a good finish. In railroad repair shops, this type of milling machine is also used for both facing off the boxes and for cutting the shoe and wedge grooves. For facing driving boxes, a number of boxes are put on the table and finished with one operation. For milling the shoe and wedge grooves, it is usual to place two boxes parallel with each other on the table. The horizontal milling machine is also used for milling the shoes and wedges.

The width between the uprights of the machine shown is 37½ in. The maximum height of the spindle above the table is also 37½ in., and cutters up to 16 in. in diameter can be used. The cross-rail is counterweighted and is arranged so that the bearing of the

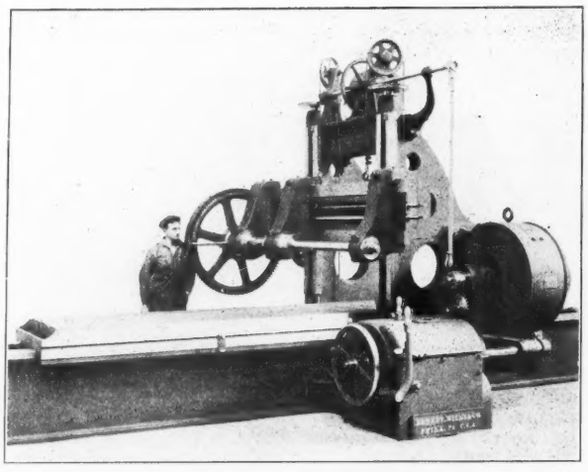


Fig. 2—The Niles-Bement-Pond No. 6 Horizontal Milling Machine.

outer end of the mandrel may be traversed entirely free of the mandrel, thus allowing the easy insertion of different mandrels. The spindle is supported by two bearings, each of which is provided with means for taking up wear. The inner bearings are adjustable along the cross-rail for the different lengths of cutters, and the bearing for the cutter mandrel is also adjustable along the cross-rail. The spindle is placed so as to permit of end or side milling. The table has power feeds in both directions, and quick power traverse as well as rapid and fine hand adjustment. The feeds are positively driven through gearing and are variable throughout a wide range. Adjustable automatic stops are also provided for the table feeds.

Fig. 3 shows a No. 4 plain milling machine made by the Cincinnati Milling Machine Company, Cincinnati, Ohio. This type of milling machine is used for doing such work as was formerly done on shapers and small planers, such as connecting rod brasses, driving box shoes and wedges and similar smaller parts of locomotives. The table of this machine is 64 in. long by 16 in. wide overall, and has a working surface of 52 in. by 16 in. and is provided with three ¾-in. T slots. The full width between the face of the column and the brace is 25¾ in. The feeds are all automatic in either direction. The longitudinal feed is 42 in., the cross feed is 10 in. and the vertical feed is 21 in. The overhanging arm is of solid steel 5 in. in diameter and its under side is 7¾ in. from the center of the spindle. There are two arbor supports supplied with each machine, each of which is provided with a bronze brush. The spindle is of crucible steel $3^{11}/_{16}$ in. in diameter in the front bearing, and has a $^{13}/_{16}$-in. hole through it. It runs in babbitted boxes which are provided with adjustment for wear. The driving

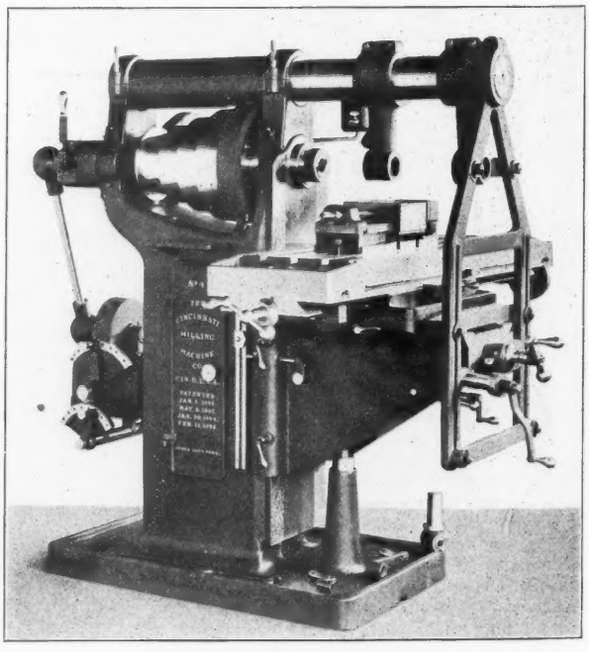


Fig. 3—The Cincinnati No. 4 Plain Milling Machine.

cone has four steps for a 3½-in. belt, ranging in diameter from 8 in. to 14 in. The spindle has 16 speeds ranging from 6½ to 312 r.p.m. The feed is positive and is also provided with 16 changes ranging from .006 in. to .300 in. per revolution of spindle. The floor space required for the machine is 82 in. x 125 in. These dimensions include an allowance for the extreme limits of the table travel. The net weight is about 4,900 lbs. When desired these machines can be fitted with motor drive, in which case the motor is mounted on an extension which is cast on, and forms part of the base of the machine. The drive is then obtained by means of a silent chain connected to a wheel on the clutch shaft which in turn is connected by another silent chain to a wheel on the spindle.

The No. 2 Universal milling machine shown in Fig. 4 is made by the R. K. LeBlond Machine Tool Company, Cincinnati, Ohio. This type of milling machine is practically of the same construction as the plain type of milling machine except that provision is made for swiveling the table and automatically rotating the universal head. They are especially adapted for tool room use, or where there is a large variety of work, as they can perform every

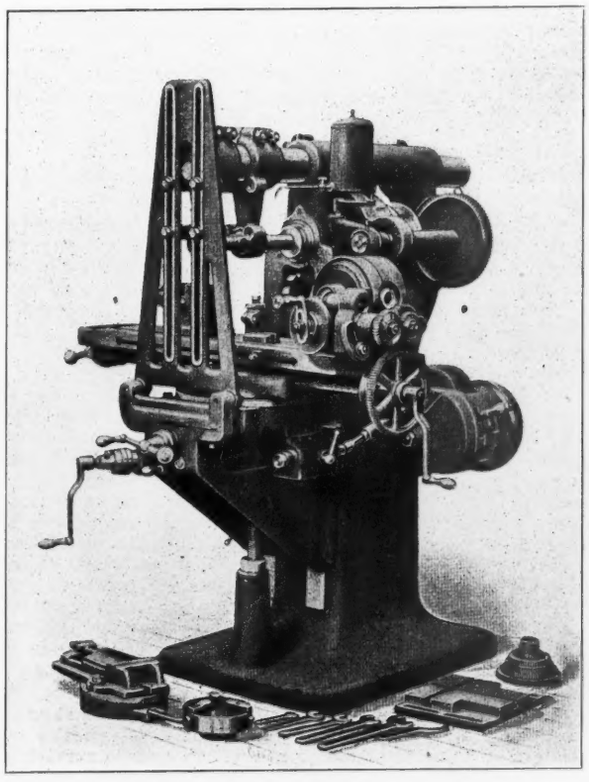


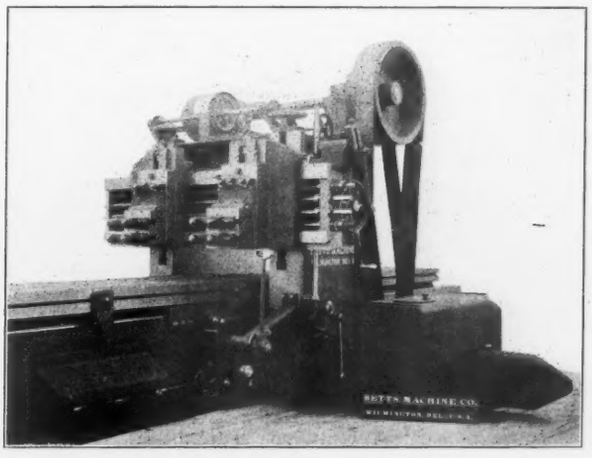
Fig. 4—The R. K. LeBlond No. 2 Universal Milling Machine.

operation of which a plain miller is capable and in addition many other varieties of work such as cutting spirals, notching worm wheels, etc. The machine shown has an automatic transverse feed of 8 in., a vertical movement of 18½ in., and automatic longitudinal movement of 29 in., all of which are graduated to the one-thousandth part of an inch. The table has a working surface of 42 in. by 10 in., and the length over-all, including oil pockets, is 50 in. It can be swiveled to 45 degrees each way for cutting spirals, and is provided with three T slots for holding work. There are 15 changes of feed, for every spindle speed, ranging from .006 in. to .143 in. The spindle is back geared and can be readily adjusted to compensate for wear. Its front bearing is 3 in. in diameter. The cone has three steps, the largest being 11 in. in diameter. The overhanging arm is of solid steel and is fitted with two supports. At its extreme position it is 22 in. from the end of the spindle. The spiral head swings 10 in. and takes 23 in. between centers. The spindle can be set 10 deg. below the horizontal each way and can be turned completely over from one side to the other. The tail stock is fitted with a vertical adjustment above and below the center for use in taper work. An index plate is furnished with each machine, which will divide all numbers up to 50, all even numbers to 100, and most uneven numbers to 360. Spirals from one turn in 1½ in. to one turn in 137 in. can be cut on this machine. The countershaft has double friction pulleys 12 in. in diameter and should run at 185 and 250 r.p.m. With a three-step cone 12 spindle speeds ranging from 18 to 500 r.p.m. can be procured. The net weight of this machine is about 2,710 lbs.

(To be continued.)

The Betts Extra Heavy Frog and Switch Planer.

The accompanying illustration shows a 36-in. frog and switch planer, made by the Betts Machine Company, Wilmington, Del. This machine planes 37 in. wide and 18 in. high, and any desired length. It is built very massive to successfully carry its great power, which is transmitted through friction clutches from a 6-in. driving belt to the all-steel driving gears. The cross-rail is unusually deep and separate feed rods and screws are provided for each operation. The feed adjustment is at the end of the cross-rail, convenient for the operator, and is operated from a positive feed box which only uses power at the instant of feeding. The cross-rail only has 18 in. of travel, but it is provided with power movement so that the workman cannot have any possible excuse for working with extended tools. The table travels on "V" tracks, which are gibbed at the center to prevent lifting under heavy cutting. The driving mechanism can be arranged for the machine to stand parallel with or at right angles to the line shaft. The feeds are positive, operating the tools at any angle. The cross-rail is of box girder form with deep arches back, and when desired can be made of sufficient length, when using two saddles, to permit of one head planing the entire width between uprights. The uprights are of double plate construction thus insuring rigidity for side cutting. The side heads can be furnished with independent power feeds in either direction. An arrangement is provided by means of which the workman can throw out the clutch pilot mechanism and operate



The Betts Frog and Switch Planer.

the clutches direct. The countershaft is carried on the uprights and runs in ring-oiling, self-adjusting bearings. It is belt driven from a 15-h.p., type S, Westinghouse motor, 220 volts d.c., which is placed on the floor back of the machine.

Four of these machines have just been furnished to the Lorain Steel Co., Johnstown, Pa.

Single-Phase Electric Traction.*

The direct current interurban railway has its limitations. If a region be sparsely settled the available traffic will not show a profit on the cost of circuits and rotary converter sub-stations. There is a material reduction in the investment and operating expense incident to the single-phase railway that will enable it to be built and operated with a profit in cases where the traffic would not support a rotary converter system. In heavy service the direct current has not made much headway, being handicapped by the heavy cost of sub-stations and of conductors. Heavy and relatively infrequent trains are the hardest loads for sub-stations. For example, if sub-stations be eight miles apart each will supply eight miles of track. A train running 40 miles an hour will receive current from a given sub-station for 12 minutes. In order that a sub-station may be continuously supplying current to trains in one direction they must have a headway of 12 minutes. If they be an hour apart the current from each sub-station is used but one-fifth of the time. Trains in two directions will double the sub-station output, but as the peak load is considerable when two trains pass near a sub-station the load factor is extremely low. Therefore as the aggregate capacity of the sub-stations must be large in proportion to the actual power taken by the cars, it follows that the sub-stations will involve a relatively large expense if they are equipped with expensive rotary converters and require constant attendance, whereas the cost will be relatively small if they require simply lowering transformers having an efficiency very much higher than

*Extracts from a paper by Charles W. Scott, read at the convention of the American Street Railway Association, Philadelphia, September, 1905.

the rotary converter sub-station and not requiring attendance. The reduction in the sub-station is therefore of especial value when the service is infrequent. Moreover the single-phase equipment by reducing the size of conductors frequently enables the sub-stations to be more widely separated. This possibility in the reduction in the number of sub-stations and in the aggregate capacity of sub-station equipment, as well as the elimination of rotary converters with their energy losses and their attendants makes practicable the operation of long distance roads which could be operated by direct current only at an excessive cost.

The single-phase system therefore decreases the cost of installation and operation for the kind of interurban service which has been successfully developed by the direct current, and it extends the field of commercial operation to include, on the one hand, rural roads with relatively light traffic, and on the other, a heavy, infrequent, multiple unit or locomotive service for passengers or for freight approximating steam railroad conditions.

If the single-phase road is to be an extension of an existing road it may be desirable to run the single-phase cars over the tracks which have a direct current trolley wire. While single-phase cars can be arranged to operate from a direct current trolley wire, it handicaps in some measure the single-phase equipment. The addition of resistance to the car equipment, extra switches, etc., for enabling the change to be made in the current supply is obviously objectionable. It is best, therefore, to keep single-phase equipments free from operation on direct current if it be practicable to do so. When it is found necessary for them to operate from an existing direct current trolley wire, the motors are connected two in series for 500 volts, and if there be four motors the two pairs may be connected first in series and then in parallel as in ordinary series-parallel control. The transformer is cut out, and the control apparatus and motors operate in substantially the same way as those on an ordinary car.

The single-phase railway which shows the most extensive operation as measured in car miles is the Indianapolis & Cincinnati Traction Company. Operation was begun over a short length of track January 1, and on April 1 37 miles were covered. Since July 1 a regular schedule has been maintained over 41 miles, 37 miles of which is under alternating current trolley and the remaining four miles is under direct current trolley in Indianapolis. The company has 10 cars, each equipped with four 75-h.p. motors. A maximum speed of 60 to 65 miles per hour is secured and the cars are not only the heaviest but they operate upon the fastest schedule of any of the numerous suburban roads radiating from Indianapolis. Some defects have developed in the equipment, which, however, have been incidental in character, and not in those new features where trouble might reasonably have been anticipated. It was found that the natural ventilation under the car was insufficient for the transformer and a ventilating motor was added. A weak point developed in the armature insulation when the cars, which had been running for some time by alternating current, were first run regularly over the direct current lines into Indianapolis. One feature of the new condition was the opening of the circuit with four motors in series, the motors having laminated fields which give greater field discharge than solid poles. The remedy was obviously the strengthening of the insulation. This brings out the interesting fact that operation on alternating current at 3,300 volts with an intervening transformer is less severe upon the motor than operation on direct current at 500 volts. Experience showed wherein the control apparatus, suitable for both alternating and direct current could be simplified and the apparatus reduced in quantity. The result is a control system which is relatively simple and compact, although suitable for operation interchangeably between alternating current and direct current.

The best verdict upon the working of the single-phase system on this road at Indianapolis has been given by the operating company. It is found in the contracts which have been placed for extending the present line a distance of 16 miles; also in extending the single-phase operation to the Shelbyville line, both to the 29 miles which have been operated by direct current and for a 20-mile extension. The length of track is therefore to be increased from about 40 to 100 miles; the number of cars will be double the present number and all equipments will be similar. It is significant that a company which has been operating two substantially similar suburban lines, one by single-phase current and the other by direct current, should see fit to throw out the direct current and substitute single-phase alternating current. It may be noted that this course was taken, although the reverse was easily possible, as provision was made in the original contract for the single-phase apparatus by which it would be exchanged for direct current equipments if its operation proved unsatisfactory.

Other single-phase roads which are operating Westinghouse equipments show a variety of conditions, some having exceptionally sharp curves and steep grades. On the road between Derry and Latrobe, in Pennsylvania, 30-ton cars are started on a 10 per cent. grade. The cars have platform controllers and are equipped with four 50-h.p. motors. In some cases the initial operation has been handicapped on account of incompleteness, or through the use of temporary apparatus either in the power house or on the car. In its fundamental elements, however, the operation is proving perfectly satisfactory.

The extension to long distances will soon be shown in the carrying out of the contract which has been closed by the Spokane & Inland Railway Company for 150 miles of railroad running south from Spokane, Washington. The equipment will consist of 15 motor passenger cars each with four 100-h.p. motors, six motor freight cars, each with four 150-h.p. motors and six 40-ton freight locomotives which may be in pairs for heavy trains.

The most notable recent event in electric traction is the purchase of Westinghouse single-phase locomotives by the New York, New Haven & Hartford. The passenger trains on this road which enter Grand Central Station in New York run over the tracks of the New York Central for about 12 miles. As steam locomotives cannot enter the new terminal station and as the New York Central is equipping its track for direct current it is imperative that the New Haven trains be handled over 12 miles by direct current power. Instead of changing from electric to steam locomotives for all local and through trains at the end of 12 miles it was decided to extend the electrification and to do it, not by extending the direct current, but by changing to alternating current. The single-phase locomotives will be designed so that they may operate interchangeably from direct current or from single-phase alternating current.

Picked Up on the Road.

BY GULF.

Apropos of the present discussion on cheap wheels and poor material; it was a good many years ago, just following the time when all men believed and acted on the principle that a cast-wheel could only be made of high grade charcoal iron, that a man walked into the office of a well-known master car builder. Now this car builder had wide reputation as an outspoken individual and one who believed in good goods as an economical proposition. Perhaps the man did not know this; at any rate he offered the master car builder wheels for about three dollars a piece less than he had been paying. The M. C. B. was on his feet like a flash: "You infernal scoundrel," he said; "you know as well as I do that you can't make a decent or a safe wheel for that price, and here you come thinking that you can tempt me to risk my trains and the lives of their crews and passengers just to make a better temporary showing to the management. Get out of here and don't you ever come back with an insult like that. You ought to be in state prison and if anything ever happens I'll do my best to put you there." I sometimes wonder if a little more of the same spirit would not be a blessing to the railroad.

The external and internal appearance of the high car-window has features to be highly commended, but if we consider the passenger who wishes to open the window they are not all that can be desired. The size is such that they can only be opened about 10½ inches, and this leaves the lower rail within a disagreeable range of the eye, so that the passenger neither looks above nor below it. If the window cannot be raised to a height of at least 21 in. it would be just as well to limit the rise to about 6 in. This would keep the rail below the level of the eye and still admit a considerable quantity of air for ventilating and cooling.

Since the memory of man engineers have advocated the sand-blasting and thorough cleaning of metal work previous to cleaning. It is a curious coincidence that in spite of this universal agreement as to what should be done it rarely happens that that same thing is done. In the painting of bridges and elevated structures the sand blast is seldom used, but the scraper in the hands of an ignorant workman takes its place—a workman who not only has no conception of the importance of his work but whom it would be impossible to convince of it. So the loose rust and scale and dirt is scraped off and the paint applied on a surface that will go on serenely rusting beneath the covering. These things came to mind when seeing just such a piece of work on a gilt edged trunk line, where things are supposedly done just right, a supposition that outsiders are not disposed to acknowledge as correct. Since in this particular instance there was the best chance in the world to use the sand blast and it could have been done at a minimum expense, the question naturally arises as to why it was not done.

Following the example of that illustrious gossip Sairy Gamp, I usually refrain from naming names, but sometimes I am sorely tempted to do so, especially when my own comfort is concerned. The case in point is that of a tunnel which I pass through morning and evening. In the evening after the cars have been exposed to the sun all day, the combination of heat and tunnel air causes so much discomfort that it is greatly dreaded. To close the deck ventilators before the train starts would create intolerable condi-

tions. So, just as the train enters the tunnel a brakeman starts down from the front car to close these ventilators. He goes down closing one side, back on the other and then scurries to the rear of the car to take the next one. Thus he walks the length of each car three times before the last ventilator is closed. We are well into the tunnel, with smoke and gas pouring in before the work is done. It occurs to the lay mind, to whom all things seem simple, that it would be a good idea to use deck ventilators so connected that they can be closed from one end of the car by the movement of a single lever. The device is in use elsewhere but perhaps it costs more.

It came somewhat as a surprise, that statement, at the topical discussion on water legs at the Master Mechanics' Convention, in which it was urged that the inner sheet of the firebox be kept vertical or given a slight outward slope so that the steam as it was generated would rise along the surface of the sheet, while with an inward slope the steam would rise through the water space and impede circulation. This is undoubtedly true, but the question arises whether it is not better to have the inward slope with the increasing water space towards the top, and therefore increased opportunity for circulation than to force the water away from the sheet, cover it with steam only, reduce the steam production and subject the plates to the danger of overheating. Current practice favors the inwardly sloping sheet, as will be seen by an examination of the boilers illustrated during the past few months in the *Railroad Gazette*.

It is interesting to note how, after more than half a century of independent and almost antagonistic practice the railroads of America and Europe are gradually approaching a resemblance. It does come somewhat as a surprise, however, to find that the bar frame for the American locomotive has actually gained a foothold, and it will be interesting to watch developments and see whether it can hold its own or not. The plate frame has had such absolute sway in the past that it almost takes one's breath away to think of it. Of course, they have been tried before, but somehow they have had a bad reputation, and it is only recently, apparently, that they have been tried in a manner that seems to promise permanency in the practice.

Speaking of European practice, those who have admired the beauty and fineness of finish on French and German engines have often thought it comparable in point of usefulness and economy with the putting of a crocus finish on a crowbar. And now comes the claim that all this fine work is paid for by the saving of time in the erecting shop. It will probably take more than the mere assertion to convince an American builder of the truth of such a statement, and we shall probably continue in our old ways for the time being. To the casual observer it would appear that the probable reason for the differences in practice in this regard is that abroad the engineer of rolling stock has a comparatively free hand to follow all the niceties of his scientific and artistic inclinations in the designing and building of his engines; while here he is being constantly crowded down to the necessity of shaving expenses and cost to the uttermost farthing.

The American types of heavy cars and engines are gradually gaining a recognition abroad, one of the latest examples being a steel car of 40 tons capacity for the Paris, Lyons & Mediterranean. The peculiar feature about this car lies in its exemplification of the old saying that Frenchmen are very saving of materials and lavish in labor, while the American is lavish in material and saving of labor. The car in question shows that the utmost care has been taken to so distribute the material of the sills that it is disposed in the best possible manner to sustain the stresses to which it will be subjected. But the amount of work involved in its construction would drive an American builder crazy. It is curious to note how these little things indicate the economic conditions of the two countries, and it makes one shudder for the welfare of home industries to think what foreign competition would mean if its labor were utilized as efficiently and economically as our own.

The *Four Track News* of August is rapturous over the fast New York-Chicago schedules. It says: "A reckless run of a few miles is of no real value. It is the trains that make the run from New York to Chicago and Chicago to New York and sustain a schedule, be it 18, 23 or 28 hours, that enter into the calculations of men. It is the leaving and arriving times that count, not the possible cannon ball flight of a mile or two somewhere along the route. The economic train is the one that, through all ordinary conditions, 'gets in' on time every day in the week." Well, this is encouraging. In season and out of season, I have preached the gospel that the business man would rather travel on a slow schedule and "get in" on time, than on a fast one and arrive an hour late, and now comes this support from a source so unexpected. When will a management appear with the courage to raise the schedule times so that all trains can "get in" on time, "through all ordinary conditions." Some roads need such a management most woefully. I recently had occasion to watch the performances of a Chicago-New York train for two weeks. Its nearest approach to arrival on time was a half hour late. From that it extended to three hours. I would like to paraphrase the statement of the *Four Track News* and say: It is not the especially coddled high-speed train that raises a road in the estimation of men and counts; but the everyday "ordinary" express, used by the great majority, which, by a punctual arrival on time in rain or shine enables the traveler to make positive engagements, earns a reputation for its road and causes the patrons to speak well of its performance.

There is no doubt of the good done and doing by the railroad branches of the Young Men's Christian Association, and there is just as little doubt that there is ample room for the widening of this good influence in little things. Cleanliness and godliness, according to the old proverb, are near of kin, but the relationship seems to have been lost to sight in many of the houses that are supposed to be models of all that is attractive. It is especially in the restaurants that this is noticeable. If these concessions are rented, it should be with the distinct understanding that the kitchen and dining room shall be subject to the same rigid inspection that once obtained in the canteen of an army post. There is no reason why, because a low price is charged for meals, the surroundings should not be immaculate in their cleanliness, or why a man who is compelled to eat in his working clothes should not like to have his surroundings clean. These remarks are apropos of a few meals taken in the building at a busy point on a great trunk line, whose dining rooms could have given points to an eating house in the slums. So bad was it that the men kept away from it except when force of circumstances drove them to it. There was nothing the matter but dirt, but there was plenty of that. It was just a case that called for the interference of the man higher up who could do no better than go in and have a "reg'lar clearin' up time."

To the altruistic philosopher whose experience in practical life has been limited, the Jim Crow car naturally seems an abomination; but to the every day man it is, to use a popular expression, "all right." All through the south it meets with the hearty approval of every white man, and West Virginia alone holds out for the common car. Not but that the Jim Crow arrangement is heartily endorsed and desired, but political interests forbid and the people look with envy on their favored neighbors. Hence, to the knock-about man, the present northern agitation for legislation to abolish the race distinction in cars seems like kicking against the bricks of a firmly established and well-founded public opinion.

The first intimation which comes to the hungry traveler, via the Lackawanna, of the provisions which have been made (and gathered) for his comfort is the appearance of a waiter properly attired in white coat and apron carrying under his arm a lot of large pasteboard signs, one of which he hangs up on a nail at the forward end of the car. It bears the following: "Meals now being served in dining car attached to this train. Order what you want. Pay for what you order." Lest the passenger has been sleeping, reading, or admiring the view during this performance the waiter soon returns, announces the meal in the usual way and also hands to each passenger a copy of the day's menu neatly printed on a sheet of paper. In the dining car, food and service are of the best; electric fans insure the free circulation of air, but if this is not sufficient the diner on a warm day will find a fan of the old-fashioned type convenient at hand. For the latter, however, it appears that he is indebted not so much to the dining car superintendent's solicitude for his comfort as to the enterprise of the makers of a certain preparation for the cure of headaches, indigestion and—car sickness! In a little brass pocket attached to the woodwork by each table a lead pencil for writing out the order is to be found.

Foreign Railroad Notes.

A valuable hunting dog, which ran loose, by his owner, on reaching a German railroad crossing where the gates were closed, dashed under or over the gate, was run over and was left no longer useful for hunting, but for nothing except perhaps sausage. The owner sued; he claimed that the railroad should have made the gate dog-tight. But the court said it was the owner's own fault. He should have led the dog when approaching a crossing.

On assuming charge of the Italian State Railroads July 1, General Manager Bianchi issued a general order addressed to all employees in which he announced that the country expected a reduction in the cost of operation, permitting lower rates, greatly needed for the development of the national industries; that he would require much of his subordinates, but would do his best to secure proper reward for efficient service; promotions would go to those who show industry and capacity. He would exercise severe disci-

pline towards all who fail to contribute towards the economy, safety and punctuality of the public service.

The greatest railroad shipping station in Germany is Duisburg-Ruhrort, the Pittsburg of the Rhine. In 1903 this place, or these places (they have been united into one municipality recently) received and shipped 22,900,000 tons of freight by rail and 18,500,000 by water. Hamburg had a freight business of 25,600,000 tons by water, but only 4,000,000 by rail; Berlin, 10,600,000 by rail and 8,250,000 by water.

Italian newspapers having reported that the Simplon Tunnel would be opened May 1 next, simultaneously with the Milan Railroad Exhibition, the Swiss who are building the tunnel say that the present state of the works warrants them in saying that trains will pass through before the end of this year, and probably by Dec. 1.

Concrete-Steel Signal Battery Vaults.

Concrete, strengthened with steel, is an ideal material for signal battery vaults because of its waterproof, non-corrosive and indestructible character. The illustrations given herewith show several designs of such vaults. Fig. 1 is a vault 4 ft. 6 in. in diameter inside and weighing about 2,700 lbs. The drawing also shows the lining employed, where one is desired. It is made of creosoted matched lumber with a metallic, hermetically sealed sheathing attached to the outer surfaces—top, sides and bottom—to which the material composing the vault firmly adheres.

Fig. 2 is a turret type, adapted for placing deep in the earth below the frost line. The neck or turret is built and shipped separately from the vault. It is cemented to its seat by a material specially prepared to make a strong, tight joint. The standard size for these vaults is 6 ft. diameter by 6½ ft. high inside, and the turret is 3 ft. x 3 ft. inside. This type has a shoe-rim to give strength and protection at the bottom and provide a safe means of lifting. The vault weighs 4,700 lbs. and the neck 1,300 lbs.

Fig. 3 is a multi-sectional design which requires no hoisting apparatus for handling. A duo-sectional design is made for use in places where water in the excavation cannot be wholly pumped out and where a derrick for heavy lifts is not available. Another design for extremely cold climates has the lining stopped off some little distance below the vault top, with an inner cover at the top of the lining. The space above this inner cover can be used for storage purposes.

A demonstration of the strength of these vaults was made by filling a number of 6-ft. x 6½-ft. turret-type vaults having shoe-rims, each weighing 5,000 lbs., with water while on a car, transporting them to the place where they were to be used and lifting them off the car into their permanent positions. Each weighed about 15,000 lbs., but the 2-in. walls, floor, etc., of the vaults withstood the stress without apparent injury. The hooks in the shoe-rim, not being designed for such heavy loading, straightened out. The smaller sizes of the vaults are handled from a yoke inside, which engages them under the shoulders.

Three cylindrical types of vaults are made, the rest being elliptical in plan. The latter can be made with the major axis varying from 4½ to 15 ft. The elliptical vaults have advantages over the cylindrical type, it being possible to transport more of them of equal storage capacity on a car; also, they may be placed between two closely adjacent tracks, a position which might be impossible with a cylindrical vault of equal capacity.

These "Hydrolithic" concrete-steel vaults are made by the E. J. Winslow Company, Chicago.

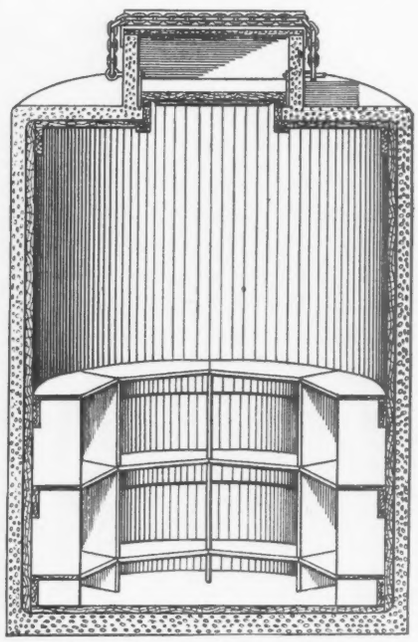


Fig. 1.

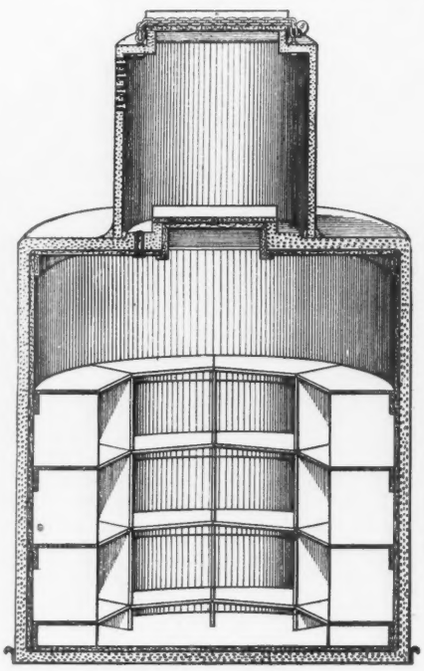


Fig. 2.

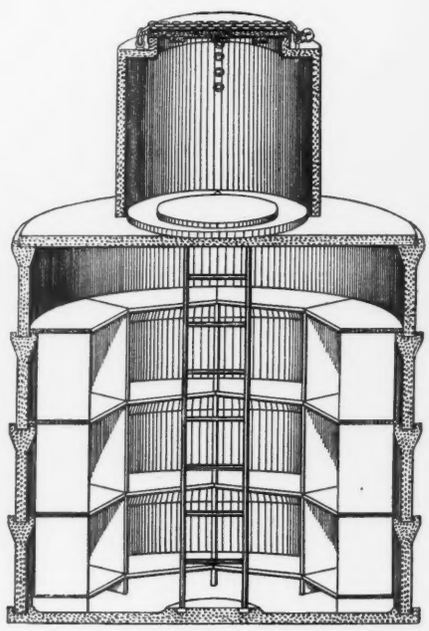


Fig. 3.

GENERAL NEWS SECTION

NOTES.

A press despatch from Sioux City, Iowa, says that those telegraph operators of the Great Northern who did not join in the recent strike on that road received checks for the month of September amounting to just double the amount they had earned.

At Houston, Tex., recently a switching engine of the International & Great Northern took fire, while its tender was being filled with fuel oil, and every combustible part of the engine and tender was entirely consumed. The fire is said to have started at a leak in the pipe leading from the tender to the firebox.

Reports from Seattle say that the Oregon Railroad & Navigation Company has notified the Railroad Commissioners of the State of Washington that it will claim the right to make its own freight rates, thus ignoring the new law empowering the commission to regulate freight rates.

The Chicago & Alton has taken off the "interurban" passenger trains which were put on a few months ago between Carlinville, Ill., and Springfield, 38 miles. The company has been unable to finish the double tracking of this part of the line and on a single track the new passenger trains interfere too much with the heavy freight traffic.

Probably Got a C. L. Rate.

The railroad cars and locomotives ordered in the United States early this year by the Japanese Government are now being shipped by way of the Pacific coast. The carrier "Dakota," of the Great Northern Steamship Company, sailed from Seattle on September 20 with 900 freight cars and nineteen 50-ton locomotives. These cars and engines are narrow gage, the cars being 16 ft. long, with a capacity of 10 tons.

Incidents of a Derailment.

Ed Carey, a former resident of Wichita, was a passenger on the California Limited which was wrecked near Walton Wednesday night about half-past 9 o'clock. Mr. Carey describes the wreck as follows:

"I went into the barber shop, which is in the buffet car, and was sitting down waiting for my turn, a woman being in the chair having her face massaged. Suddenly the coach gave a lurch and seemed to stand on end, then began to bump and create a terrible noise. . . . The woman scrambled to her feet and began to scream, at the same time making frantic efforts to jump out of a window. I caught her in my arms and thus saved her from jumping to instant death, all the time expecting the crash to come, as I thought we were in some kind of a collision. Britt, the brother of the prize-fighter, fought like a demon to get out. The car suddenly left off its bumping and plowed into the south bank of a cut, lying over on its side. The woman, whom I still held, kept repeating: 'Oh, the bridge, the bridge,' no doubt recalling to mind some past wreck. I finally succeeded in quieting the woman and hurried to the rescue of others. Everyone was terribly excited except one old invalid lady, who was calmly sitting down on the side of the car in which she was riding and asking for her father, who was on the train but escaped uninjured. The conductor of a freight following about one mile behind saw the train leave the track and he said that it looked as if on fire, and that the noise could be heard that far back very distinctly."

Mr. Carey said that the railroad men treated them all very nicely with the exceptoin of the conductor, who through a misunderstanding of his duties tried to make the passengers sign a release of all damage claims before he would haul them into Newton. . . . It was laughable to see the passengers feign injuries after mention of damages was made.—*Wichita (Kan.) Eagle.*

Rate Regulation vs. Government Ownership.

Professor Ripley in the *Atlantic* says that it is not the immediate question of railroad rates which most concerns Mr. Roosevelt. He is made anxious by the strength of the movement for government ownership of railroads. "Will it not be better that the attention of this huge electorate should be diverted from such issues by the prompt application of really remedial legislation, before the question is too widely advertised in a Presidential contest? The President of the United States is neither demagogue nor socialist. He realizes the irresistible force of public opinion when once fully roused; he is well aware that public ownership of railroads is no mere dream of idle theorists, but an accomplished fact in many foreign countries; and he foresees the political dangers latent in such a programme for our own country."

But, how long will a newspaper-reading and demagogue-driven electorate allow itself to be "diverted," when the net is so ostentatiously spread in sight of the bird? Is not Mr. Roosevelt putting a powerful argument in the hands of Mr. Bryan and his Socialist allies? There is the further question, When is public opinion "irresistible"? According to the test supplied by Professor Ripley, Mr. Roosevelt would have been for the Granger legislation, because public opinion in the western States demanded it imperiously. Professor Ripley quotes with approval President Hadley's opinion that, even if the Interstate Commerce Commission were given power to fix railroad rates, the number of changes would be "very small indeed." Yes, but one can hear the roar coming across the prairies; "What was all the excitement about, then? You were simply trying to 'divert' the honest electors, and all you have given them is a rate on shoe-pegs and canary-seed. Get out of the way and let the real servants of the people take hold of the weapon you have forged, and use it to some effect!" The best way is to tackle political questions separately as they arise, and on their own merits. That there are abuses in railroad administration cannot be denied. If more thorough-going statutes are needed by all means let us have them. But let us have the legislation in and of itself, here and now, with sufficient reason shown, and without these dire insinuations about what the great peril will do to us if we do not take the plunge into the small peril.—*New York Evening Post.*

Prevention of Spontaneous Combustion of Coal.

The Moniteur Industrielle says that the common method of attempting to avert spontaneous combustion in piles of bituminous coal by the insertion of ventilating pipes is usually futile because of the small diameter of the pipe used. A better precaution is to drive an iron or steel bar down into the mass and allow it to remain until it has reached the temperature of the coal in which it is imbedded. A touch of the hand will then be sufficient to indicate whether the heat is sufficient to cause ignition or not. Or the bulk of a thermometer could be set in the bar.

The precautions to be taken against the overheating of the coal pile are: Never heap up damp coal; always keep it in steel or concrete bins and never near the boilers. The pile should never be more than 11½ ft. deep and a free circulation of air around and beneath it when possible. If overheating and ignition does take place the pile should be dug away and turned. Throwing on water is of little use, since if it penetrates into the mass it will only aggravate the difficulty. If the coal cannot be turned, and the fire is in the center, it is a good idea to drive large perforated pipes down into the mass and then force a current of water down through them which will quickly extinguish the fire.

Single-Phase Electric Railway in Washington.

The Westinghouse Electric & Manufacturing Company has obtained the contract for equipping with single-phase electric apparatus the Spokane & Inland Railway, which is building from Spokane, Wash., to Moscow, Idaho, 146 miles. The road is completed for 34 miles out of Spokane, and will be put in operation as soon as possible. The company expects to do a heavy freight business and to carry mail and express as well as passengers. Power will be bought from the Washington Power Company, which will supply three-phase current at 4,000 volts, 7,200 alternations to a frequency-changing station. Here seven 750-k.w. oil-insulated, water-cooled transformers will step down the voltage from 4,000 to 2,000 volts, the potential for which the induction motors of the frequency changing sets are wound. There will be four of these motor-generators or frequency changers of 1,000-k.w. capacity each at normal rating. Each consists of a 1,000-h.p., 3-phase, 2,000-volt, 60-cycle induction motor; a 1,000-k.w. single-phase, 2,200-volt, 25-cycle revolving field alternator, and a 750-h.p., 550-volt direct-current generator which is to float on the storage battery acting alternately as a motor and generator. The three machines will be mounted on a single bed plate with seven bearings. Exciting current for the alternators will be supplied by three sets, each consisting of a 75-h.p., 3-phase, 2,000-volt induction motor and a 50-kw. d.c. generator. Nine 675-k.w. oil-insulated water-cooled transformers will step up the voltage from 2,200 to 45,000 volts, at which pressure it will be transmitted to the 15 static transformer sub-stations, each containing two 375-k.w., 45,000-6,600 volt oil-insulated, self-cooling transformers. A 23-panel switchboard, electrically-operated, automatic oil circuit breakers, and protective apparatus complete the equipment of the frequency changing station. Low equivalent lightning arresters and choke coils are provided for both primary and sec-

ondary circuits in all sub-stations. The transmission lines will consist of two No. 2 copper wires, and the trolley will be of the standard catenary construction, using a No. 000 wire and carrying current at 6,600 volts.

Each passenger car will be equipped with four 100-h.p. motors, capable of maintaining a schedule speed of 35 to 40 miles an hour. In the freight service four 150-h.p. motors will be used on each car. For the heavy freight service double locomotives weighing approximately 70 to 80 tons will be used, each consisting of two parts and each part a complete 35 to 40-ton locomotive. Two or more of these locomotives may be coupled together and operated from the front cab as a single unit. The motor cars and locomotives will all be operated by the Westinghouse multiple unit control system. The motors will operate under three different conditions—6,600 volts alternating current in the interurban districts, 700 volts alternating current in the smaller towns, and 575 volts direct current in the city of Spokane.

The Kirkwood Combination High and Low Pressure Oil Burner.

The accompanying illustration shows the Kirkwood combination high and low pressure oil burner made by Tate, Jones & Co., Inc., Pittsburg, Pa. Actual tests have shown that oil burned under high pressure, that is from 5 to 20 lbs., is considerably more efficient than when burned under a low pressure of from 4 oz. to 1 lb. While a very small amount of the air is required to atomize the

The Kirkwood Combination High and Low Pressure Oil Burner.

oil, a much larger amount is required for combustion, and where compressed air for both the atomization and combustion have to be supplied to a burner, the expense for large compressors and their operation is quite an item and in many cases has prevented the use of the more efficient high-pressure system. With the Kirkwood combination burner it is claimed that only one-tenth of the usual amount of compressed air is required for atomization. The necessary air for combustion is supplied by a blast fan at 3 oz. to 4 oz. This is inexpensive to purchase and requires very little power to operate and a more complete regulation of the fire can also be obtained.

In this burner both the compressed air and the oil are controlled by one lever, and the burner is adjusted so that the proper proportion of compressed air and oil is always right for atomization. This adjustment cannot be changed, and the burner, therefore, always atomizes perfectly. The supply of air is regulated by a gate on the blast pipe. Dry steam fed to the burners at the same pressure as the oil may be used for atomizing. As only enough steam is used to break up the oil the burner is noiseless and the amount of steam used is small. These burners will operate equally well with the heavy crude Texas and California oils as with the lighter oils. A number of furnaces in The Ramapo Iron Works, Niagara Falls, are equipped with this combination burner, and it is claimed that they have affected a large saving in the oil burned.

Manufacturing and Business.

The American Water Softener Co., Philadelphia, reports orders for water softening and purifying plants from the Florida East Coast Railway, and the Detroit, Toledo & Ironton Railway.

The Climax Stock Guard Co., Chicago, during August and September sold 21 car loads of "Climax" cattle guards to the following: Wisconsin & Michigan, Missouri, Kansas & Texas, Central of Georgia, Long Island, and Chicago & Alton railroads, and Westinghouse, Church, Kerr & Co.

In the description of the new private car "Alexandra" built by Rhodes, Curry & Co., Ltd., for the Canadian Government, which appeared in our issue of October 6, page 331, it was stated that the car was equipped by the Electric & Train Lighting Syndicate with the Pintsch system of train lighting. The car was equipped by this company with Deutsch system of train lighting.

Iron and Steel.

Inquiries are being made for structural steel in lots of from 6,000 to 12,000 tons. The largest of these are from railroads. Additional contracts have recently been placed for rails aggregating 80,000 tons by northwestern roads. The Northern Pacific has given an order to eastern mills, bringing its total up to 60,000 tons; the Chicago & North-Western, 20,000 tons, and another western road, 15,000 tons. September contracts for fabricated steel given to the American Bridge Co. are for 30,000 tons, and contracts are pending for a large tonnage in addition. One inquiry is for 16,000 tons. The Dominion Iron & Steel Co., according to reports from Canada, is negotiating with the Chinese Government to supply a large quantity of rails for the Hankow Railway. The total length of this road will be 800 miles, 30 miles of which had been built by an American syndicate, when the concession was bought back by the government. The Dominion Iron & Steel Co. has been given a contract by the Grand Trunk Pacific for about 150,000 tons of rails to be delivered within five years.

PERSONAL.

—Mr. A. O. Cunningham, who was recently appointed Chief Engineer of the Wabash, was born in 1866 at Rangoon, British Burmah. He began railroad service in 1886 as rodman on the Northern Pacific. From 1890 he was for a year engaged in surveying in North Dakota. He then went to the University of Minnesota, graduating in 1894. After graduation he was draftsman to the Gillette-Herzog Mfg. Co., becoming in the next year Assistant Engineer of that company. From 1896 to 1898 he was General Contracting and Engineering and Southern Agent for the Schultz Bridge & Iron Co., of Pittsburg. In 1898 he went to the Pittsburg Reduction Co., and in 1899 was associated with the Pennsylvania Engineering Co., a firm of consulting engineers. He went to the American Bridge Co. in 1900 as Contracting Manager, at Cleveland, Ohio, and in 1902 became Bridge Engineer of the Wabash, where he has remained until his present appointment.

A. O. Cunningham.

—Mr. George T. Nicholson, hitherto Passenger Traffic Manager of the Atchison, Topeka & Santa Fe, was on October 4th made Third Vice-President in charge of traffic, succeeding to the position vacated by Mr. Paul Morton when he became Secretary of the Navy. Mr. Nicholson is 49 years old, having been born in Belvidere, N. C., in 1856. Practically his entire railroad career has been spent in the service of the Santa Fe, which he entered in 1882 as clerk in the general passenger and ticket office, after graduation from the Kansas State University. He became in turn rate clerk, chief rate clerk, chief clerk and Assistant General Passenger and Ticket Agent. At the end of ten years he had risen to the head of the department, having been made General Passenger Agent in 1892. In 1897 he became General Passenger Agent of the St. Louis & San Francisco, but the following year returned to the Santa Fe as Passenger

G. T. Nicholson.

Traffic Manager, the position he now leaves to take control of all traffic of the Santa Fe system.

—Mr. M. Donaldson, who was recently appointed Superintendent of the Ottawa division of the Grand Trunk, was born in 1851 in Scotland. His first railroad service was in 1881, as Chief Draftsman of the Canada Atlantic, becoming later Master Mechanic and Purchasing Agent, and then Superintendent. In 1898 he was appointed General Superintendent, where he remained until October 1, of this year, when the Grand Trunk took over the operation of the Canada Atlantic as its Ottawa division.

—Mr. E. W. McKenna, who has been elected Second Vice-President of the Chicago, Milwaukee & St. Paul, was born in 1848 and entered railroad service in 1862 as messenger and operator on the Pennsylvania. In 1864 and 1865 he was in the United States military telegraph service. From this time until 1870 he held various positions on the Pittsburg, Cincinnati & St. Louis, being appointed Train Despatcher at the end of that time. In the next year he was appointed Superintendent of the Indianapolis & Vincennes, and in 1880 went to the Jefferson, Madison & Indianapolis, with the same title. In 1886 he went to the Pennsylvania Lines West, performing special service under the immediate direction of the General Manager. The next year he became Chief Clerk to the General Manager of the New York, Lake Erie & Western, and in a few months went to the Chicago, Milwaukee & St. Paul, as Superintendent of the Prairie du Chien and Mineral Point divisions. In 1888 he was made Superintendent of the La Crosse and Wisconsin Valley divisions, in 1890 Assistant General Superintendent, and in 1894 General Superintendent of the Eastern district of the Great Northern. In 1895 he left railroad service to become President of the McKenna Steel Working Co. He returned to the Chicago, Milwaukee & St. Paul in 1904 as Assistant to the President, holding that office until his recent appointment.

E. W. McKenna.

ELECTIONS AND APPOINTMENTS.

Atchison, Topeka & Santa Fe.—C. A. Morse has been appointed Acting Chief Engineer with office at Los Angeles, Cal., succeeding R. B. Burns.

H. C. Whitehead, General Auditor at Chicago, has been appointed Consulting Auditor. W. E. Bailey, Assistant Auditor, succeeds Mr. Whitehead. J. E. Baxter, Auditor of the Gulf, Colorado & Santa Fe, succeeds Mr. Bailey. J. W. White, Auditor of Disbursements, has resigned, effective October 15. A. L. Conrad succeeds Mr. White, with office at Topeka, Kan.

Atlantic & Birmingham.—G. C. Smith, Acting Superintendent, has been appointed Superintendent, with office at Brunswick, Ga. A. Bonnyman has been appointed Chief Engineer, with office at Oglethrope, Ga.

Buffalo & Susquehanna.—F. H. Goodyear has been elected President and C. W. Goodyear, Vice-President, both with offices at Baltimore, Md. M. E. Olmsted has been appointed General Counsel, with office at Harrisburg, Pa.

Canada Atlantic.—C. M. Hays, Second Vice-President and General Manager of the Grand Trunk, has been elected President of the Canada Atlantic, succeeding C. J. Booth. E. H. Fitzhugh, Third Vice-President of the Grand Trunk, has been elected Vice-President. Frank Scott, Treasurer of the Grand Trunk, has been elected Secretary and Treasurer, succeeding A. W. Fleck, resigned. H. W. Walker has been appointed General Auditor, succeeding W. S. Smith, resigned.

Canadian Pacific.—J. W. Leonard, Superintendent of Construction on the Toronto-Sudbury branch, has been appointed to the newly created position of Assistant General Manager of lines east of Fort William, Ont., with headquarters at Montreal. He will continue to supervise the construction of the Toronto-Sudbury line.

Carolina & Northwestern.—E. F. Reid has been appointed General Freight and Passenger Agent, and J. R. Hall, Auditor, both with offices at Chester, S. C.

Central Indiana.—John Cullinan has been appointed Master Mechanic, with office at Muncie, Ind., succeeding S. W. Crawford.

Chicago, Burlington & Quincy.—V. O. English, Superintendent of the McCook division, has resigned. C. L. Eaton, Assistant Superintendent of Transportation at Omaha, Neb., succeeds Mr. English. F. D. Weidenhammer succeeds Mr. Eaton.

Chicago, Milwaukee & St. Paul.—H. R. Williams, General Manager, has resigned.

Chicago, Rock Island & Gulf.—G. W. Barr has been appointed Superintendent of Telegraph, with office at Fort Worth, Tex., succeeding A. B. Crowley, assigned to other duties.

Chicago Terminal Transfer.—J. R. McGary has been appointed Car Accountant, with office at Chicago, Ill., succeeding H. L. Meier. The office of Engineer of Tracks and Structures has been abolished.

Chicago, Ziegler & Gulf.—U. S. Long has been appointed Traffic Manager, with office at Chicago, Ill., succeeding H. H. Hiland.

Colorado Midland.—W. J. Schlacks has been appointed Superintendent of Machinery, with office at Colorado City, Colo., succeeding J. R. Groves.

Colorado Springs & Cripple Creek District.—J. B. Flaherty, Assistant Superintendent, has been appointed Superintendent, with office at Cripple Creek, Colo. A. L. Boyd has been appointed Purchasing Agent, with office at Canon City, Colo.

Denver, Enid & Gulf.—F. D. Hunt has been appointed General Superintendent, with office at Enid, Okla. T.

El Paso & Southwestern.—L. U. Morris has been appointed Superintendent of the Western division, with office at El Paso, Tex., succeeding F. L. Hunter, promoted.

Fort Worth & Denver City.—G. Geiger has been appointed Superintendent, with office at Childress, Tex., succeeding G. W. Rourke, resigned.

Georgia, Florida & Alabama.—E. O. Alston, General Freight and Passenger Agent, has resigned. G. H. McWilliams, Traveling Freight Agent, in Tennessee, of the Louisville & Nashville, succeeds Mr. Alston, with office at Bainbridge, Ga.

Grand Trunk.—W. G. Brownlee, Superintendent of the Middle division, has been promoted to take charge of the Operating department, heretofore within the jurisdiction of F. H. McGuigan, Fourth Vice-President. U. E. Gillen, Assistant Superintendent of the Middle division, has been appointed Superintendent of the Middle division, succeeding Mr. Brownlee, with headquarters at Toronto, Ont.

Great Northern.—Archibald Gray, Assistant General Freight and Passenger Agent at Butte, Mont., has been transferred to Sioux City, Iowa, succeeding F. Rogers. H. A. Jackson, General Freight and Passenger Agent of the Spokane Falls & Northern, succeeds Mr. Gray.

Gulf, Colorado & Santa Fe.—D. E. Shuckhart has been appointed Auditor, succeeding J. E. Baxter, promoted. See Atchison, Topeka & Santa Fe.

Indiana Harbor.—C. W. Hotchkiss, President, has been appointed General Manager. W. S. Kinnear, Vice-President, has been appointed Assistant General Manager. W. H. Newman, President of the New York Central & Hudson River, succeeds Mr. Hotchkiss. G. J. Grammer, Vice-President of all New York Central lines west of Buffalo except the New York, Chicago & St. Louis, has been appointed Vice-President, and will be in charge of traffic.

Louisville, Henderson & St. Louis.—L. W. Botts has been elected Treasurer, with office at Louisville, Ky.

Missouri, Kansas & Texas.—W. A. Mitchell has been appointed Master Car Builder, with office at Sedalia, Mo., succeeding H. A. Bowen.

Missouri, Oklahoma & Gulf.—A. R. Peyinghaus, General Freight and Passenger Agent, has resigned. W. O. Maxwell succeeds Mr. Peyinghaus.

Missouri Pacific.—J. F. Simms, Trainmaster at Sedalia, Mo., has been appointed Superintendent of the Central Kansas division with office at Osawatomie, succeeding A. DeBernadi, promoted. John Cannon has been appointed Superintendent of the Southern Kansas division, with office at Coffeyville, Kan. J. G. Lorton has been appointed Superintendent of the Valley division, with headquarters at McGehee, Ark., succeeding K. G. Morley, resigned. P. G. Walton, Trainmaster at Poplar Bluff, Ark., has been appointed Assistant Superintendent of the Arkansas division, with office at Wynne, Ark.

Mobile, Jackson & Kansas City.—J. G. Glazier, Superintendent of the Toledo Railway & Terminal, has been appointed Superintendent of the Mobile, Jackson & Kansas City, with office at Mobile, Ala.

New York Central & Hudson River.—F. E. Herriman, General Coal Agent, has been appointed to the newly created position of Coal Traffic Manager of this road and of the Rutland. H. W. Henry, Assistant General Coal Agent, succeeds Mr. Herriman.

Northern Pacific.—W. G. Johnson, Auditor of Disbursements, has been appointed Assistant Comptroller. G. J. Mayer succeeds Mr. Johnson. The offices of both are at St. Paul, Minn.

Oregon Short Line.—F. H. Plaisted, District Freight and Passenger Agent at Boise, Idaho, and C. I. Tuttle, General Live Stock Agent at Salt Lake City, have been appointed Assistant Freight Agents at Salt Lake City, Utah, and their former offices have been abolished.

Pennsylvania.—Samuel Rea, Fourth Vice-President, has been elected Third Vice-President, with the same duties as at present, succeeding S. M. Prevost, deceased. J. B. Thayer, Fifth Vice-President, has been elected Fourth Vice-President in charge of the traffic duties formerly performed by Mr. Prevost. Henry Tatnall, Sixth Vice-President, has been elected Fifth Vice-President, retaining the duties of Treasurer, and the office of Sixth Vice-President has been abolished. C. E. Pugh, Second Vice-President, has been elected director of the Baltimore & Ohio, the Norfolk & Western, the Chesapeake & Ohio and the Long Island, succeeding Mr. Prevost.

Philadelphia & Reading.—W. G. Edmunson has been appointed Engineer of Tests, with office at Reading, Pa.

Reid Newfoundland Company.—W. E. Hamilton has been appointed General Passenger Agent, with office at St. Johns, Newfoundland, succeeding H. A. Morine.

Reidsville & Southeastern.—G. D. Mackay, Secretary and Treasurer of the Darien & Western, has been elected President of the Reidsville & Southeastern also. H. D. Emerson, Vice-President and General Manager of the Darien & Western, has been elected to the same position on this road also. R. Denmark has been elected Secretary.

Rio Grande, Sierra Madre & Pacific.—D. J. Timlin, Master Mechanic, has resigned, and his office has been abolished. The jurisdiction of H. M. Levinson, Superintendent, has been extended over the Mechanical department.

Southern Pacific.—T. A. Graham has been appointed Assistant General Freight and Passenger Agent, with office at Los Angeles, Cal.

Spokane Falls & Northern.—H. A. Jackson, General Freight and Passenger Agent, has resigned. See Great Northern.

Suffolk & Carolina.—C. L. Hutchins, General Manager, has resigned. F. B. Dewey succeeds Mr. Hutchins.

Tennessee.—The office of Superintendent has been abolished.

Terminal Railroad Association of St. Louis.—A. Robertson, General Manager, has resigned, effective November 1. See Western Maryland.

Toledo Railway & Terminal.—J. G. Glazier, Superintendent, has resigned. See Mobile, Jackson & Kansas City.

Toledo, St. Louis & Western.—A. Shane has been appointed Superintendent of Bridges and Buildings. D. Nowlan has been appointed Superintendent of Roadway and Track.

Wabash.—F. A. Delano, First Vice-President, has been elected President.

Western Maryland.—A. Robertson, General Manager of the Terminal R. R. Association of St. Louis, has been appointed General Manager of the Western Maryland and of the West Virginia Central, with office at Baltimore, Md., effective November 1.

Wheeling & Lake Erie.—B. A. Worthington, First Vice-President of this road and of the Wabash-Pittsburg Terminal and the West Side Belt, has been also appointed General Manager.

Wisconsin & Michigan.—M. F. Schulze has been elected Auditor and L. E. Hart, Secretary, succeeding O. A. Koss, Secretary and Auditor, resigned.

LOCOMOTIVE BUILDING.

The Chicago & North-Western, it is reported, is figuring on locomotives.

The Central of New Jersey is asking bids on 20 consolidation locomotives.

The Indiana Harbor has ordered 10 mogul locomotives from the American Locomotive Co.

The St. Louis, Brownsville & Mexico, it is reported, has ordered nine locomotives from the Baldwin Works.

The Northern Pacific, as reported in our issue of September 29, has ordered 80 locomotives from the American Locomotive Co.

The Republic Iron & Steel Company has ordered two locomotives from the American Locomotive Co. for use at its Youngstown, Ohio, plant.

The Canadian Pacific, it is reported, has just placed an order with the American Locomotive Co. for 35 ten-wheel Canadian Pacific class "700" passenger locomotives.

The Michigan Central has ordered 15 consolidation locomotives from the American Locomotive Co. These are to be made at the shops of the Locomotive & Machine Co. of Montreal.

The Kansas City, Fort Scott & Memphis, it is reported, will shortly be in the market for 10 switching locomotives, five ten-wheel passenger locomotives and 15 ten-wheel freight locomotives.

The Southern, as reported in our issue of September 22, has ordered 90 locomotives. Of these, 25 have been ordered from the Baldwin Works and the remaining 65 from the American Locomotive Co.

The Pennsylvania Lines West of Pittsburg have ordered 10 class H-6a consolidation freight locomotives (adapted to use the Walschaert valve gear), five H-6b locomotives and 15 B-29 shifting locomotives from the American Locomotive Co. The H-6a and the H-6b locomotives will be made at the Pittsburg Works, and the B-29 locomotives will be made at the Schenectady Works of the American Locomotive Company.

The Kansas City Southern, as reported in our issue of August 18, has ordered eight switching and 12 freight locomotives from the American Locomotive Co. The consolidation engines will weigh 205,000 lbs., with 185,000 lbs. on drivers; driving wheels, 55 in. in diameter; cylinders, 22 in. x 30 in.; straight boiler, with a working steam pressure of 200 lbs.; firebox, 120 in. x 41 in.; 300 tubes, 14 ft. 6 in. long x 2 in. in diameter; capacity of tender, 6,000 gallons of water and 10 tons of coal. The switching engines will weigh 130,000 lbs.; diameter of drivers, 51 in.; cylinders, 19 in. x 26 in.; straight boiler, with a working steam pressure of 180 lbs.; firebox, 108 in. x 41⅞ in.; 280 tubes, 11 ft. 6 in. long x 2 in. in diameter; capacity of tender, 4,000 gallons of water and eight tons of coal. The special equipment includes: Otis steel firebox, Midvale tires, Franklin K. & M. boiler covering, Railway Steel Spring Co.'s springs, Consolidated Locomotive Safety Valve Co.'s safety valves, Ohio injectors, Climax couplers, Damascus bronze journal bearings, Chicago triple-feed lubricators, Ashcroft steam gages, Baltimore sanding device, Otis steel axles, cast-steel wheel centers and Tyler tubes.

CAR BUILDING.

The Peoria & Eastern is in the market for 100 box cars.

The Chicago, Milwaukee & St. Paul is figuring on passenger cars.

The Texas Southern, it is reported, will shortly buy about 10 box cars.

The Philadelphia & Reading, it is reported, is figuring on 100 flat cars.

The Union Tank Line, it is reported, is buying material for 100 tank cars.

The Chicago & North-Western is reported as being in the market for 18 passenger cars.

The Southern Iron Car Line, it is reported, has ordered 100 cars from the Georgia Car Co.

The Cleveland, Cincinnati, Chicago & St. Louis has ordered 20 cabooses from the Pullman Co.

The Pabst Brewing Co., Milwaukee, it is reported, is in the market for 100 refrigerator cars.

The Ozan Lumber Company has ordered 20 logging cars from the American Car & Foundry Co.

The Grand Trunk Pacific, it is reported, has ordered 2,000 freight cars from the Canada Car Co.

The Erie, it is reported, has placed an order with Barney & Smith for an experimental steel passenger coach.

The Autofagasta Railroad Company, of Chili, has ordered 17 passenger cars from the Wason Manufacturing Co.

The Baltimore & Ohio denies having ordered 500 coal cars from the American Car & Foundry Co., as reported in our issue of Oct. 6.

The Japanese Government: It is reported that the Western Steel Car & Foundry Co. is figuring on 500 box cars for the Japanese Government.

The Evansville & Mt. Vernon Traction Company, as reported in our issue of September 22, has placed an order for a number of cars with the St. Louis Car Co.

The Argentine Republic has just placed an order with the Wason Manufacturing Co. for 10 passenger and six baggage cars. These are to be used on the government railroad.

The St. Louis, Brownsville & Mexico, in addition to its orders reported in our issue of October 6, has ordered 12 tank cars of 8,500 gallons capacity from the Bettendorf Axle Co.

The Chicago, Burlington & Quincy has ordered 1,000 box cars of 80,000 lbs. capacity from the Pullman Co., and it is reported that it has also ordered two café cars from the same company.

The Kansas City, Fort Scott & Memphis, it is reported, will shortly be in the market for the following car equipment: Five hundred gondola cars, 500 twin hopper cars, 40 dump cars, 100 steel drop bottom cars, 10 combination mail and baggage cars, and six postal cars.

The Central of New Jersey, as reported in our issue of September 29, has ordered 1,000 box cars, 1,000 coal cars and 1,000 gondola cars from the American Car & Foundry Co. It has also ordered 1,000 steel hopper gondola cars of 100,000 lbs. capacity from the Cambria Steel Co.

The Chicago, Rock Island & Pacific has ordered 750 40-ft. cars of 80,000 lbs. capacity and 250 40-ft. furniture cars of 50,000 lbs. capacity from the American Car & Foundry Co. The special equipment includes: Simplex bolsters, Buffalo brake-beams, Miner draft rigging and McCord journal boxes.

The Pittsburg & Lake Erie, as reported in our issue of Oct. 6, has ordered 200 composite gondola cars of 100,000 lbs. capacity from the Pressed Steel Car Co., for March, 1906, delivery. The special equipment includes: Carnegie axles, Simplex bolsters, Westinghouse air-brakes, Camel brasses, R. E. Janney couplers and Gould journal boxes.

The Chicago, Lake Shore & Eastern, as reported in our issue of Oct. 6, has ordered 800 gondola cars and 200 flat cars of 100,000 lbs. capacity from the Western Steel Car & Foundry Co. The special equipment for both includes: Simplex bolsters, Westinghouse air-brakes, Miner draft rigging, McCord journal boxes and Railway Steel Spring Co.'s springs.

The Central New England, as reported in our issue of Sept. 22, has ordered 10 cabooses from the Wason Manufacturing Co. These cabooses will weigh 25,100 lbs., and measure 23 ft. 1 in. long, 9 ft. 3 in. wide, and 13 ft. 8 in. high, over all. The special equipment includes: Sterlingworth brake-beams, Diamond "S" brake-shoes, Tower couplers and Butler draft rigging.

The Central of Georgia, as reported in our issue of Sept. 22, has ordered 50 dump cars of 80,000 lbs. capacity from the Rodger Ballast Car Co., for October delivery. These cars will weigh about 35,600 lbs., and measure 34 ft. long and 10 ft. 3 in. wide, over all. The special equipment includes: Common Sense bolsters, Sterlingworth brake-beams, Westinghouse air-brakes, Tower couplers, Miner tandem draft rigging and standard arch-bar trucks.

The St. Louis, Brownsville & Mexico, as reported in our issue of Oct. 6, has ordered eight day coaches, three combination cars and three 60-ft. baggage cars from the Barney & Smith Car Co.; and 100 36-ft. stock cars, 50 36-ft. box cars and 40 refrigerator cars of 60,000 lbs. capacity from the American Car & Foundry Co., for Dec. 15th delivery. The special equipment for the stock and box cars includes: Westinghouse air-brakes for the stock cars and Tower couplers for the stock and box cars.

The Mexican Central, as reported in our issue of September 29, has ordered 10 box cars of 60,000 lbs. capacity from the Mexican Car & Foundry Co. These cars will weigh 31,000 lbs., and measure 37 ft. 6⅜ in. long, 9 ft. 2⅝ in. wide and 13 ft. 3 in. high over all. The special equipment includes: American Steel Foundries' bolsters, National-Hollow brake-beams, Westinghouse air-brakes and draft rigging, Tower couplers, Wagoner door fastenings, Soule dust guards, McCord journal boxes, Sherwin-Williams paint, Mexican Central corrugated iron roofs and trucks and Pittsburg Spring & Steel Co.'s springs.

The Seaboard Air Line, as reported in our issue of Sept. 22, has ordered 15 wide vestibule passenger cars from the American Car & Foundry Co. These cars will weigh 98,000 lbs., and measure 61 ft. long, over end sills; 9 ft. 8 in. wide and 14 ft. 3 in. high, over all. The special equipment includes: National-Hollow brake-beams, Westinghouse air-brakes, Janney couplers, Forsyth curtain fixtures and material, Adams & Westlake door fastenings, Seaboard Air Line doors, draft rigging, trucks and wheels, Safety heating system, Pintsch light, Murphy's or Flood Conklin's paint, Chas. Scott Spring Co.'s springs and Pullman standard vestibules.

The Kansas City Southern, as reported in our issue of September 8 and 22, has ordered five chair cars, two passenger and mail cars, 100 stock cars of 60,000 lbs. capacity, and 1,000 box cars of 80,000 lbs. capacity from the American Car & Foundry Co. The box cars will measure 36 ft. 6 in. long x 8 ft. 5⅜ in. wide x 8 ft. high, and will be fitted with Scullin & Gallagher steel bolsters. The special equipment for the stock cars will include: Scullin & Gallagher bolsters and Damascus brake-beams. The chair cars will be fitted with steel bolsters, Westinghouse brakes, Janney couplers, Hewitt Manufacturing Co.'s journal bearings, Safety Car Heating & Lighting Co.'s lighting system, Baker heaters and Pullman vestibules. The passenger and mail cars will be 60 ft. long and will be fitted with practically the same special equipment.

The Pennsylvania Lines East of Pittsburg have ordered the following freight car equipment: One thousand three hundred class Xla box cars and 4,060 class Gsd gondola cars from the Pressed Steel Car Co.; 2,300 class Gsd gondola cars from the American Car & Foundry Co.; 1,500 class Gsd gondola cars from the Standard Steel Car Co., and 300 class Xla box cars from the Middletown Car Works; a total of 9,460 cars. The lines west of Pittsburg have ordered 2,000 class Gsd gondola cars from the Pressed Steel Car Co.; 300 class Fm flat cars, 1,100 class Kf stock cars, 1,800 class Xla box cars and 1,000 class Gla gondola cars from the American Car & Foundry Co., and 500 class Xla box cars from the Western Steel Car & Foundry Co., a total of 6,700 cars, making a total of 16,160 cars in all ordered by the lines both east and west of Pittsburg. A brief mention of the above was made in our issue of September 29.

The Union Pacific System has ordered from the American Car & Foundry Co. 101 passenger cars as follows: Fifteen coaches for the Union Pacific, five coaches and two baggage cars for the Oregon Short Line, five coaches and four baggage cars for the Oregon Railroad & Navigation Co., and 10 baggage and 60 chair cars for the Southern Pacific. Deliveries will be made at the rate of 30 cars per month. Commencing Feb. 1, 1906, 15 cars will be delivered from the St. Charles and 15 from the Jeffersonville Works. The coaches will have a seating capacity of 70 persons, and will measure 67 ft. 8¾ in. long, 10 ft. ⅜ in. wide and 14 ft. 1$^{9}/_{16}$ in. high over all. The special equipment includes: American Car & Foundry Co.'s axles, Diamond special brake-beams, American Brake-Shoe & Foundry Co.'s brake-shoes, Hewitt brasses, Janney couplers, Curtain Supply Co.'s curtain fixtures, Pantasote curtain material, Adams & Westlake door fixtures, Miner draft rigging, Union Pacific dust guards, Consolidated Car Heating & Lighting Co.'s heating system, Pintsch light, Standard Steel Co.'s platforms, Railway Steel Spring Co.'s springs, Union Pacific standard trucks, Pullman vestibules and Standard Steel Co.'s wheels. The chair cars have the same dimensions and special equipment, except that they have a seating capacity of 58 persons and measure 76 ft. 11¾ in. long over all. The dimensions and special equipment for the baggage cars are the same as for the coaches. In addition to the above, the Union Pacific System has ordered from the Pullman Co. 20 passenger cars as follows: Five observation and smoking cars and six baggage cars for the Union Pacific, one dining and two observation and smoking cars for the Oregon Railroad & Navigation Co., and six dining cars for the Southern Pacific. Four of the baggage cars will be for the San Pedro, Los Angeles & Salt Lake and will be equipped with dynamos.

BRIDGE BUILDING.

Bedford, Ky.—Bids are wanted October 16 by J. H. McMahon for building a steel bridge 70 ft. long over Cane creek, in Trimble County. W. C. Morgan is County Clerk.

Little Rock, Ark.—An ordinance is before the City Council providing for the construction of a viaduct at Argenta over the Little Rock & Fort Smith and the St. Louis, Iron Mountain & Southern tracks on Main street. The cost of the work will be about $27,500.

Marion, Ohio.—Bids are wanted October 24 by L. N. Hipsher, County Auditor, for building a bridge with a steel superstructure over the Scioto river at the site known as Newman Bridge, to consist of one span 188 ft. long to carry a single track, with a roadway of 16 ft.

Mitchell, Ont.—A steel bridge 120 ft. long will be built on the twelfth concession of Grey.

Norfolk, Va.—The War Department has granted the application of the Norfolk Viaduct Corporation for permission to build a

cantilever electric car bridge over the Elizabeth river between this place and Berkley to be 175 ft. above low water and 600 ft. long. The cost of the work will be about $350,000.

North Vancouver, B. C.—A new bridge with a 180 ft. span is to be built at Seymour Creek.

Ottawa, Ont.—The county council has decided to build a steel bridge over the Rideau river.

Philadelphia, Pa.—Both branches of the Philadelphia City Council have passed ordinances to authorize a loan of $6,000,000, $4,000,000 of which will be used to abolish grade crossings; but the ordinance will not become effective until approved at the polls.

Peterboro, Ont.—The city council is having plans made for an overhead steel bridge across the Otonabee river at Hunter street.

Pine Bluff, Ark.—Plans are being made to build a free bridge over the Arkansas river, which is to be a combined railroad and highway bridge.

Racine, Wis.—The plans submitted by Engineer John Geist, as ordered by the city, call for a swing bridge to be built on the line with Main street. The approaches are to be of cement and the cost of the work will be $67,000. The City Council may soon authorize the asking of bids for this work.

San Jose, Cal.—Bids are wanted October 16 by Henry A. Pfister, Clerk of the Board of Supervisors, for building a bridge over the Guadalupe creek on Willow street in Santa Clara County.

Shelbyville, Ind.—A contract has been given to L. H. Fish, of this place, to build a new bridge and repair three others over Robinson creek.

Shreveport, La.—The City Council of Shreveport has begun preliminary work towards the construction of a free traffic bridge over the Red river, and will make the surveys in accordance with the direction of the War Department under the act recently passed by Congress.

Spokane, Wash.—Bids are wanted October 19 by F. P. Weymouth, President of the Board of Public Works, for building a bridge over the Spokane river at Mission avenue, to consist of one 150-ft. span and one 200-ft. span or of four 92-ft. spans. Bids will be accepted for either a steel superstructure with tubular piers or for a reinforced concrete structure with concrete superstructure.

Toronto, Ont.—Steel bridges will be built over the tracks of the Grand Trunk at Bathurst street and the Canadian Pacific in the Island Park, at a cost of about $75,000.

Ventura, Cal.—Arrangements have been made by the County Commissioners to raise $50,000 to be used towards building two bridges, one over Sespe creek near Fillmore and the other over the Ventura river at Casitas Pass.

Other Structures.

Brampton, Ont.—The Grand Trunk, it is said, will build a new passenger station to cost about $40,000.

Glassport, Pa.—The Pittsburg & Lake Erie is planning to build repair and machine shops at this place to cost about $100,000.

Owensboro, Ky.—The Louisville & Nashville has given a contract to Walter Brashear, of Henderson, for putting up a brick union passenger station to cost $35,000. It will be used jointly by the Louisville & Nashville, the Illinois Central and the Louisville, Henderson & St. Louis.

Pittsburg, Pa.—A contract has been given by the Pennsylvania to W. F. Trimble & Sons Co., of Allegheny, for building an inbound freight house on the Duquesne Way elevated line in Pittsburg. The plans call for a brick building 48 ft. wide and 900 ft. long, one-half of which is to be four stories high and the remainder one story. The cost of the work will be about $450,000, and 3,000 tons of structural steel will be required for the frame work.

Varcoe, Man.—The Canadian Pacific is to build a new station here.

Winnipeg, Man.—The Canadian Northern will shortly call for bids for the construction of a number of stations along its new extensions.

It is reported the Canadian Pacific has bought ground as a site for a new station.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Augusta & Florida.—This company, which is building a railroad from Midville, Ga., north through Burke and Richmond Counties, via Keysville to Augusta, a distance of 60 miles, having been unable to secure trackage rights over the Southern from Keysville to Augusta, proposes at once to extend its road from that point north to Augusta, 20 miles. (See Construction Record.)

Cairo & Thebes.—Incorporation has been granted a company under this name in Illinois, with a capital of $10,000, to build a railroad from Cairo, at the southern end of Alexander County, Ill., northwest to Thebes, about 25 miles. The incorporators include: E. A. Smith, W. J. Johnson, D. Hartman, G. J. Becker and J. H. Galligan, all of Cairo.

Canadian Pacific.—This company is planning to build a branch from a point near Wolseley, on the main line, to Reston, on the Souris branch, 122 miles.

Cananea, Yaqui River & Pacific.—This company, which operates 40 miles of road from Naco, Ariz., southwest to Cananea, Mex., is to extend its road south from its southern terminus and also northeast towards the boundary line to a connection with the Southern Pacific.

Chesapeake & Ohio.—This company, it is said, is planning to build a branch line at Main Shelby creek, in Kentucky, for a distance of about 20 miles into a rich coal and timber section. Surveys for this work have been made and rights of way are being secured.

Chicago & Alton.—Work is under way on the construction of 50.66 miles of second main track from Sherman, Ill., northwest to Bloomington. This will, when completed, give the Chicago & Alton a double track from Chicago to Iles, 187.2 miles, counting the Coal City branch as part of the double track. In this connection, the grades between Carlinville and Bloomington are being reduced to 0.3 per cent. northbound, thereby securing this low grade all the way from the Illinois coal fields to Chicago.

Chicago, Burlington & Quincy.—This company, according to newspaper reports, will begin work on a new line in the Big Horn Basin in Wyoming. The proposed route is from Fannie, in the northern part of Big Horn County, east along Polecat creek to the Big Horn river, thence south along the river to Warland, which will be the southern terminus, a distance of about 100 miles. The new line will open up more than 250,000 acres of irrigated land. It is thought that the line will eventually be connected with the line from Bridgeport, Neb., to Guernsey, Wyo., and made a part of the main line.

Chicago, Desplaines & Fox River.—Articles of incorporation have been filed in Illinois by a company under this name with a capital of $1,000,000, to build a railroad from Chicago north and northwest through the counties of Cook and Lake to McHenry County, Ill., a distance of about 50 miles. The incorporators include: George W. Bryson, William S. Reed, Ernest T. Ross, Walter C. Gunn and William K. Kenly, all of Chicago; office in Chicago.

Chicago, Weathersford & Brazos Valley.—A contract has been given by this company to the McCarthy-Miller Construction Co., of Lufkin, Tex., to build this proposed road from Weathersford, Tex., via Springtown and Pooleville to Bridgeport, a distance of 35 miles. The road may eventually be extended farther south to Granbury or Glen Rose. The road is supposed to be an independent project, but will make connections with the Rock Island. The city of Weathersford has contributed $65,000 towards the construction of the line. The names of the incorporators are not given.

Cleveland, Berea & Southern (Electric).—This company, which has been granted a charter in Ohio, has secured all its rights of way and will soon begin construction. The proposed line is about 30 miles long. The contractors will begin in South Brooklyn and work toward a point southwest of Berea, entering that place over the Cleveland & Southwestern. From this place, a branch will be built south to Medina. C. H. Hubbell, of Cleveland, is interested.

Cleveland, Cincinnati, Chicago & St. Louis.—The first track elevation resolution, under the law passed by the last session of the Legislature, has been adopted by the Board of Public Works of Indianapolis, Ind., and has been agreed to by representatives of the Cleveland, Cincinnati, Chicago & St. Louis and the Vandalia roads. Provision has been made for the elevation of tracks and the depression of the streets at Kentucky avenue and Missouri and West street crossings, and for the erection of a new bridge over White river for the Vandalia. The latter company will elevate the tracks for a considerable distance west of White river and the Indianapolis & Vincennes trains will reach the elevation by a new route. The work will cost about $300,000, the railroads paying about 75 per cent. and the city the balance. Work will be commenced this month and is to be completed by December, 1906.

Des Moines, Iowa Falls & Northern.—This company, which operates 75 miles of road from Iowa Falls to Des Moines, has let a contract to R. A. Elzy, of Marshalltown, for building the first eight miles of its proposed extension from its northern terminus (Iowa Falls) to Hampton, in Franklin County. The road is to be eventually extended to Mason City, an additional 20 miles. (September 8, p. 79.)

FORT WORTH & MINERAL WELLS (Electric).—A charter has been granted a company under this name in Texas, with a capital of $250,000, to build an interurban electric road from Fort Worth, Tex., west to Mineral Wells, about 60 miles. The offices of the company will be at Fort Worth, and the directors include: Cicero Smith, D. M. Howard, H. N. Frost, E. J. Waldrow and A. Stevenson, all of Mineral Wells.

GAINESVILLE MIDLAND.—A charter amendment has been granted to this company in Georgia giving it permission to extend its line from Jefferson, in Jackson County, southeast to Athens, in Clark County, a distance of 18 miles, and to change the gage of the road from narrow to standard. Work is to be commenced shortly. (Aug. 25, p. 62.)

GRAND TRUNK PACIFIC.—A contract that is worth between $4,000,000 and $5,000,000 has been given by this company to Foley Brothers, Larson & Co., of Winnipeg, for building the line between Fort William and Lake Superior Junction, about 210 miles. This is the second contract let by the G. T. P. The first was given to Macdonald & MacMillan, of Winnipeg, to build the line from Portage la Prairie to Touchwood Hills. The awarding of this contract means that about 500 miles of the road will be under actual construction by the latter part of this month. The work must be completed in time to move the grain crop of 1907. This company will immediately call for bids for the construction of an additional 500 miles of track, making 1,000 miles to be under way before December.

GREAT NORTHERN.—According to newspaper reports, this company's connection with the Burlington now under construction between Sioux City and Omaha will be operated by the Burlington as a portion of that system and through trains will be run from Omaha to St. Paul and Minneapolis over the C., B. & Q. and Great Northern. The new line will be about 112 miles between Omaha and Sioux City, while that of the Chicago & North-Western is only 105 miles long.

See Vancouver, Victoria & Eastern below.

HAYNEVILLE & MONTGOMERY.—Incorporation has been granted in Alabama to a company of this name, with a capital of $50,000, to build a railroad from Hayneville, Ala., to Tyson, on the Louisville & Nashville, and thence to Montgomery; also to build a line from Hayneville to Big Swamp, in Lowndes County. The incorporators include: G. E. McGehee, Charles Schuessler and W. G. Davis, all of Lafayette, Ala.

ILLINOIS CENTRAL.—It is said that work is to be at once begun on the Jackson & Southeastern, which is a part of the Birmingham branch of this road. Construction is to be begun at Frogmore, Tenn., which is the Illinois Central lower yards, and to be continued toward Perry Switch, on the Mobile & Ohio.

INDIANA BELT (Electric).—A charter has been granted a company under this name in Indiana, with a capital of $10,000, to build a railroad from Indianapolis to Greenfield, through Maxwell, Eden, Pendleton, Noblesville, Lebanon, Danville, Martinsville, Franklin and Shelbyville. The officers are: Charles A. Barnes, President; Everet Hatfield, First Vice-President; Irving Tyner, Second Vice-President; P. Bidgood, General Manager; Thomas Beecher, Secretary and Treasurer. F. Bidgood, of Logansport, is Chief Electrical Engineer.

KANSAS CITY, MEXICO & ORIENT.—An officer of this company is reported as saying that 76 miles of the road north of Sweetwater, Tex., will be put in operation this month; also that the line east of Chihuahua in Mexico will be in operation for a distance of a little over 100 miles. It is expected to have the road from Kansas City to Sweetwater operated by the first of next year, and 1,000 miles in operation by April, 1906.

LOUISVILLE & NASHVILLE.—See Louisville Southern below.

LOUISVILLE SOUTHERN (LOUISVILLE & NASHVILLE).—According to local reports, an eastern syndicate, in which John D. Rockefeller is interested, has bought 10,000 acres of coal lands along the proposed extension of this road in upper Harlan County, Ky. It is the intention of the syndicate to build an extension of the Louisville & Nashville from a point on the Cumberland Valley division, to the coal property in Cumberland Valley, a distance of 35 miles.

MANITOBA & MIDLAND.—An office has been opened at Portage la Prairie and surveys are being made for a line from Emerson, on the international boundary north to Portage la Prairie. The promoters hope to eventually build the line to Hudson Bay.

MEXICAN INTERNATIONAL.—This road, which will be extended from Durango, Mex., to Guadalajara, a distance of about 400 miles, has been finally located from Durango to Chalchihuites, 150 miles, and construction work on this first division will be soon begun. Surveys for the balance of the road are now being made. C. G. Carroll is the engineer in charge of the work.

MORELIA & TACAMBARO.—An officer writes that contracts will be let for construction work within 30 days on this proposed road from Irapuato, on the Mexican Central, south through the State of Michoacan to Tacambaro, thence west to Ario, a distance of 225 miles. The road has been granted a number of valuable concessions by the Mexican Government; also from the State of Michoacan. C. D. Knapp, of New York, is Vice-President and General Manager. (September 29, p. 103.)

NEWARK & HACKENSACK RIVER (ELECTRIC).—Incorporation has been granted a company under this name in New Jersey with a capital of $1,000,000 and headquarters at 763 Broad street, Newark, to build an electric railroad from Park Place, Newark, to the Hackensack river. The incorporators include: T. N. McCarter, Rumson, N. J.; C. A. Sterling, East Orange; A. H. Charlton, Elizabeth; J. J. Burleigh, Merchantville; A. R. Kuser, Bernardsville; T. C. Barr, Orange, and M. T. Cox, East Orange. The Jersey City & Hackensack River Railway Company, also incorporated with a capital of $1,000,000 by the same parties, is to continue the line of the above company from that point to the intersection of Erie and Fourteenth streets, Jersey City, where it is to connect with the proposed line of the Interstate Tunnel Railway Company, which in turn is to construct the tunnel to the middle of the North River connecting with the affiliated company incorporated in New York State. The approximate length of the two lines will be seven and a quarter miles.

NEW YORK CENTRAL & HUDSON RIVER.—Work is in progress in four-tracking the line at various points between Mott Haven Junction and Croton, on the Hudson division, 29 miles. At the junction of the main line of the N. Y. C. & H. R. (old Spuyten Duyvil & Port Morris) with the New York & Harlem at Mott Haven Junction, there is a large amount of rock cutting on both sides of the present double track. North of Spuyten Duyvil along the shore of the Hudson, the shore line is being extended out into the river by filling in at available points, and two additional tracks are being laid west of the present three main tracks. As yet no buildings have been moved or crossings changed, and therefore no long stretches of track have been laid, but all parts of the line are being made ready for the four tracking. This work includes a new cut-off from a point just south of King's Bridge station, west to a point a few hundred yards east of Spuyten Duyvil, which will save nearly a mile in distance and a long and sharp curve. The rock cutting on this section is nearly completed and the work now to be done consists of grading, ballasting and bridging two short arms of the Harlem river, over which the new line will pass. Over each of these a concrete culvert is already well under way.

NEW YORK, NEW HAVEN & HARTFORD.—At a recent meeting of the Board of Aldermen of New Haven, Conn., the new proposition of this company to widen its cut through the city, which work has been under consideration for several years, was agreed to. The cut to be widened is 8,000 ft. long. Over this cut there will be 12 steel bridges to replace existing wooden structures. The cost of the work will be about $5,000,000.

NORMAN'S SOUTHEASTERN.—Incorporation has been asked for by a company under this name in Missouri with a capital of $120,000 to build a railroad 12 miles long in Stoddard County. The incorporators include: W. W. Norman, S. A. Ruch and C. A. Vernon, of Huntsville.

NORTH COAST.—Articles of incorporation have been filed by this company in Washington (authorized capital $1,000,000) to build an electric or steam road into the Yakima Valley. The incorporation is said to be with the object of building a new railroad from the Sound to the Yakima Valley, and may be a project of the Northern Pacific to secure a route through Naches Pass. The incorporators include:. F. B. Dudley, of Niagara Falls, N. Y.; R. E. Strahorn, of Spokane; J. A. Kerr and John H. McGraw, of Seattle, and O. A. Fechter and J. J. Rudkin, of North Yakima.

NORTHERN NEW MEXICO & GULF.—Incoroporation has been granted a company under this name in New Mexico, with a capital of $300,000, with headquarters at El Rito, in Arriba County, to build a railroad from the Santa Fe Central at Santa Fe northwest toward Arizona. The proposed road will cross the Tesque Pueblo grant, follow the Rio Grande north from San Ildefonso and Santa Cruz by way of Santa Clara, and thence across the Rio Grande to Espanola. It will then follow the Chama river west and the Gallinas river into Sandoval County, and thence across the Canyon Largo into San Juan County via Fruitland, to the New Mexico-Arizona boundary. There will be a branch line to Farmington, Aztec and Durango, Colo. The incorporators include: William H. Coe, of New York; E. B. Miller, of El Rito; F. E. Coe, of Denver; G. H. Howard, of Santa Fe, and G. V. Howard, of Boulder, Colo.

PENNSYLVANIA.—According to newspaper reports, surveys are being made by this company for a new freight line from Trenton, N. J., northeast to Waverly, near Newark, thus paralleling the present four-track main line for 45 miles. It is said that the surveyors crossed the Raritan river about a mile below New Brunswick.

Construction work, it is said, has been commenced by this

company on the Monongahela division from its present terminus at West Brownsville southwest to Rice's Landing, in Green County, Pa., a distance of 12 miles. The new line will develop a rich coal region which has hitherto been without transportation facilities. It is expected to complete it next spring, when a line will be built from the southern terminus north through Washington County to a connection with the Ellsworth branch, making a loop.

Work has been started on this company's new line from Beatty, Pa., to Greensburg, eight miles. The contractors are H. S. Kerbaugh on the eastern end, and Drake & Stratton on the western end. The present line, which is to be superseded, passes through a long tunnel at Donohue. The new line will be one-half mile shorter than the present one and will have a better alinement and lighter grades. About one mile of the existing line will be used, but the other seven miles will be on a new right of way and will have four tracks. The improvement is to cost approximately $2,000,000. The contractors expect to have the road ready for use early in 1907.

Pere Marquette (Erie).—This company has given a contract to Chick Bros., of Windsor, Ont., to build 15 siding tracks, each 3,000 ft. long, at St. Thomas, Ont.

Raleigh & Pamlico Sound.—An officer writes that construction work will be pushed on this proposed road which is to run from Raleigh, N. C., east via Wilson, Snowhill and Greenville to Washington, a distance of 114 miles. The company has recently been placed under new management, which is planning to extend the road from Washington to New Bern, N. C. Track has been laid for about 9½ miles and on an additional five miles grading has been completed. The officers of the company are: Charles O. Haines, President and General Manager; Adam Treadwell, Secretary and Treasurer, and John W. Stewart, Chief Engineer. The offices of the company are at Raleigh, N. C. (See Construction Record.)

Texas, New Mexico & Pacific.—A charter has been filed by a company under this name in Texas, with a capital of $1,000,000, to built a railroad from McKinney, Tex., west to a point in Cochran County, approximately 375 miles. The general offices of the road will be at McKinney. The incorporators include: L. K. Davis and W. Maple, of Chicago; J. Chain, J. L. White, J. L. Doggett, M. J. Healy and others, of McKinney.

Union Pacific.—This company, it is said, has located the line of its new cut-off to be built between Omaha and Elkhorn, on which work is to be commenced at once. The grade on the new line will be less than 1 per cent., but much grading will be necessary on the west end, where the main line will join the cut-off. The distance from South Omaha to Elkhorn by the old route is 28 miles and by the new line only 18 miles. It is proposed to run all through trains over this cut-off.

Vancouver, Victoria & Eastern (Great Northern).—President J. J. Hill, of the Great Northern, is reported as saying that construction work on the western section of this road will be rushed. A start will be made this winter at Cloverdale, where the new road will join the New Westminster Southern, now a part of the Great Northern. The contractors, dividing the work into large sections, will work east over the Hope mountains to connect with the other section of the Vancouver, Victoria & Eastern, now being built from the boundary into the Similkameen district. It will be an all-Canadian line, with a terminal at Vancouver.

Vandalia.—See C., C., C. & St. L.

Virginia Peninsula.—An officer writes that construction work will be begun within 30 days on this proposed road, which is to be operated by gasolene motors. The line is from Newport News, Va., through Bethel, Poquoson, Grafton, Yorktown, Gloucester and a number of smaller places, with a main line 20 miles long and branches of 10 miles. Contracts will be let shortly for the construction work. A contract has been given to the Penn Steel Co. for the rails. Work will be light, as there are no grades over 1 per cent. and no curves. W. A. Post is President; J. L. Patton, Vice-President, and J. L. Marye, Jr., Engineer, Norfolk, Va. (See Virginia Roads, September 29, p. 104.)

Washington Roads.—The Hamilton-Lyman Lumber Co., owning large tracts of timber lands in Skagit Valley, will at once begin the construction of a railroad from Hamilton on the Great Northern west to Sterling, a distance of 15 miles.

Western Pacific.—Announcement has been made by this company that work on its proposed road will soon be started between Oakland and Oroville. The Utah Construction Co., which has the contract for a large proportion of this road, is subletting some of the work north of Oroville, and grading on the section west of Salt Lake will be commenced shortly. The work includes a tunnel 7,400 ft. long at Spring Garden, Cal.; also one 6,000 ft. long at Beckwith Pass, Cal. The company has completed the location of its entire line between Oakland, Cal., and Salt Lake City, and is now securing rights of way.

Windsor, Essex & Lake Shore.—A charter has been granted this company in Michigan (capital $1,000,000) to build a railroad from Windsor to Chatham, passing through Tilbury and Maidstone, 120 miles. The officers are: William J. Wilson, President, of Port Huron; John W. Goodson, Secretary, of Detroit; W. C. Crawford, Treasurer, of Tilbury, Ont., and Philip Haselton, General Manager, of Detroit.

RAILROAD CORPORATION NEWS.

Canadian Northern.—The Mackenzie & Mann interests have bought the Nipigon Railway, a company which proposed to build from Nipigon Bay, on Lake Superior, to Nipigon Lake, 40 miles. This was acquired because its projected route paralleled the Mackenzie & Mann line to be built from Sudbury, Ont., to Port Arthur.

Chesapeake & Nashville.—This road and its equipment has been sold to William A. Northup, of Louisville, Ky., for $300,000 cash. It runs from Gallatin, Ky., to Scottsville, and, including an 11-mile branch, is 35 miles long.

Dominion Atlantic.—This company has purchased the Midland Railway, which is 60 miles long and runs across Hants County in Nova Scotia, connecting with the Dominion Atlantic at Windsor and with the Intercolonial at Truro.

Erie.—The Erie has offered to stockholders of record on October 21 the right to subscribe for $12,000,000 4 per cent. convertible, series B bonds, of 1953, at par and interest. These bonds are convertible into common stock at 60 between October, 1907, and October, 1917. Each stockholder may subscribe for bonds to the extent of 6.75 per cent. of his stock. The bonds are part of an authorized issue of $50,000,000, of which $10,000,000 has already been issued. The proceeds will be used to pay for the stock of the Cincinnati, Hamilton & Dayton. There were 1,603 shares of C. H. & D. stock bought from J. P. Morgan & Co. at 135, and 74,000 shares at an average of 160. This gives the Erie ownership of 75,603 out of the total 80,000 shares of Cincinnati, Hamilton & Dayton stock.

Galveston, Harrisburg & San Antonio.—This company has acquired the Galveston, Houston & Northern and assumed its operation. It will be known as the Galveston division.

Great Northern.—The long rumored "melon" to be distributed by the Great Northern has been brought to pass by a circular issued to the stockholders offering them the privilege of subscribing at par to new stock to the extent of one-fifth (20 per cent.) of their holdings on November 8, when the stock books will close. As Great Northern preferred—there is no common stock—is selling at about 325, this privilege is a valuable one, the rights having been valued on the curb market on notice of the issue at 37. On this basis the privilege amounts to a 37 per cent. stock dividend. The new issue will amount to $25,000,000, which makes the total amount of stock outstanding $149,375,600.

Nashville, Chattanooga & St. Louis.—The interest rate on all bonds which may hereafter be certified and issued under the provisions of the debenture of April 2, 1888, made with the United States Trust Co. of New York, trustee, has been reduced from 5 to 4 per cent.

New York Central & Hudson River.—Gross earnings for the nine months ending September 30 were $62,577,355, an increase of $5,089,123 over the figures for the corresponding period in 1904.

New York, New Haven & Hartford.—This company has issued an additional $5,000,000 of coupon notes, maturing October 1, 1906. This will make $12,000,000 of coupon notes outstanding, the other issues maturing at various dates in 1906 and 1907.

Richmond-Washington Company.—This company, which is a holding company in the interest of six railroads for the Richmond, Fredericksburg & Potomac and the Washington Southern, has issued an additional $2,000,000 of collateral trust 4 per cent. bonds of 1943, making $8,500,000 outstanding of the total $11,000,000 authorized.

St. Louis Southwestern.—The stockholders have authorized the guaranteeing of an issue of not exceeding $500,000 first mortgage 5 per cent. 50-year bonds of the Shreveport Bridge & Terminal, and also an agreement with that company for the use of its bridge and other property for 50 years.

Terminal Railroad Association of St. Louis.—President Roosevelt has directed the Attorney-General to proceed with the prosecution of the suit to enjoin this company from continuing its control of the two bridges and the Wiggins Ferry lines across the Mississippi river, at St. Louis. This suit has been pending two years and is brought under the anti-trust law, the government declaring the operation of the different lines by a single company as unlawful monopoly.